JANUARY 1988
ISSUE #327

73 AMATEUR RADIO

International Edition

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A WGE Publication

DEFINITELY DX!

- Long-distance Hamming
- 100 Countries in Two Days
- Novice DX Tips
- The Colvins—DXers' DXers
- Easy Propagation Prediction

DX DYNASTY AWARD

- The First 100 Winners
- Can You Meet the Challenge?

SPECIAL PROJECTS

Computerizing the FRG–7

PULLOUT EXTRAS

DX Net Schedule and
DXDA Country List

Welcome, Newcomers!

AMATEUR RADIO DEMYSTIFIED

Welcome to Amateur Radio! Since you're reading this, chances are you've just gotten your amateur license, or are seriously thinking about it.

Like any technical hobby, however, ours is full of techspeak, acronyms, and jargon that can really put off a newcomer. I recall getting my "ticket" and tuning around on an amateur band on my old Philco radio for nice slow code. After finding and copying it, less than one-tenth of it was comprehensible! I knew I wasn't dyslexic, discounted Alzheimer's disease because of age (18), and was told by a native that it wasn't Czech. I resigned myself to the fact that Amateur Radio had its own language, and I had to learn it.

Fortunately, there were fellow hams around me who wouldn't let me believe that it was hard, and, after a short time, I had too much fun to notice. A week after getting my ticket, I made my first international contact in Morse code, with a schoolteacher south of Sao Paulo, Brazil. Contacts with Argentina, Finland, Japan, and Australia followed shortly, and ham jargon and acronyms showed themselves to be the link between people with no other common language; a kind of radio Esperanto. These once alien words and symbols became bonding ones. The system that first restricted me became a liberating one.

You will hopefully have the company of enthusiastic hams like I did to ease your entry into the hobby. Meanwhile, use the following format as a key into our fascinating world.

ANATOMY OF A CONTACT

Most ham contacts follow a standardized format, and there are good reasons for it. Mike fright—not knowing what to say—is a *common* problem. Many new hams besides you, and even a surprising number of veterans, suffer from it. This isn't surprising when you consider that you're meeting someone for the first time and are still unfamiliar with the equipment, and many of us are naturally shy. It really helps to be able to start off with a protocol that soon becomes automatic. This lets you think about what you're going to say next while tuning your antenna, making final tuning adjustments on your rig, etc.

See the glossary in the December Issue for unfamiliar terms.

To Call

First tune to a clear frequency, making sure that it is in within your license class restrictions. Then, to be sure, call "Is this frequency in use from (your call)"?, or send "QRL?" Allow 5–10 seconds for a response. Repeat this procedure. If there's no response, call or send the letters "CQ" ("seek you") 6–8 times followed by your call, twice. If you're on voice, and conditions are poor, give your call phonetically, e.g. "this is 'Kilo- Alpha-One-Hotel-Yankee' for KA1HY. There are several common phonetics for each letter, which you will soon get to know.

Joe Ham will respond by first giving your call several times followed by his call. If conditions are poor, he may then say, "Do you copy?" or send "QSL?" and wait for you to respond. If conditions are better, Joe will probably just continue with a little about himself after responding to your call.

A Little About Joe

We have a tendency to forget to give details about ourselves that we consider boring, because we repeat them with each new contact. We need to remind ourselves that these details help the other person identify with us. To keep ourselves in line, we continue to follow a format.

Joe goes on by giving his name, prefaced in CW by "NAME IS . . ." He then sends "QTH IS . . ." followed by his location.

At this point, he will likely send your signal report. Code reports in CW have three parameters—"Readability, Strength, and Tone"—and are prefaced by "UR RST IS. . ." Readability follows a scale of 1 to 5, and the other parameters run between 1 and 9. In practice nowadays on CW, only the first two characters ("Readability" and "Strength") vary, since most rigs produce an excellent CW tone. "9" is often shortened to "N", e.g. an RST of "599" is sent "5NN". Voice contact reports are two characters; "Readability" and "Strength." It is often given with an "and" in between; e.g. "5 and 9."

> ***"A good wrap-up puts a nice cap on a contact."***

After this, Joe then says "How Copy?" or sends "QSL?" and you take up the mike/key and repeat exactly his transmission format.

After this, it's your choice what to talk about. Many hams' next step is to describe their station: My rig is. . ., my antenna is. . .and is up "X" number of feet, etc. If you're familiar with Joe's QTH, you can talk about it. If you're not familiar with it, you can *still* talk about it. Tell him about your other hobbies, and ask him about his. Ditto for work, family, books read, movies seen, places visited, etc. The list of topics is endless. After the contact, you'll wonder why you ever had mike fright!

Finishing the Contact

A good wrap-up puts a nice cap on a contact. Good procedure keeps the contact from ending too abruptly or dragging out.

The hardest part for most is being the first to say you have to QRT (exit). Once that hump is hurdled, you turn the mike to him. He thanks you for the contact and turns it back to you. You then thank Joe for an excellent contact, say "73s," and tell him you "will QSL" (send a card of acknowledgement), and will look for his. You then say "Over to you for your final (words), Joe." He will return and say "Thanks again and 73s. This is (his call), clear." You finish your transmission by saying "This is (your call), clear."

Remember, these patterns aren't cast in stone—they're meant only to get you started! Good Luck!

. . .de KA1HY

"Q" SIGNALS

The language of amateur radio is riddled with strange three-letter words beginning with "Q"—you may have noticed that four of our monthly departments are titled with 'em.

They first came into being in the code-only days as a way to reduce common questions and statements to a short code and make communications more efficient. "Q" was likely chosen as the first letter because it's the least common letter in the alphabet, and always always followed by "U"—if it was followed by anything else, it was a sure bet that it was a code.

"Q" signals can be either questions or statements. Here are the most common ones, followed by an example:

QRL—"Are you busy? I am busy." Send this to see if a frequency is clear.

QRM—"Is my transmission interfered with? Your transmission is being interfered with." Often said "Q-R-Mary" to distinguish it from QRN.

QRN—"Are you troubled by static? I am being troubled by static." Often said "Q-R-Nancy."

QRP—"Shall I decrease power? Decrease power." There are some hams devoted to elegance of low-power operation. Mike Bryce WB8VGE devotes his QRP column to them.

QSB—"Are my signals fading? My signals are fading." Often said "Q-S-Baker." "There's a lot of QSB on the band."

QSL—"Do you copy me, do you acknowledge? I copy, I acknowledge." Hams exchange QSL cards to verify their contacts with each other. See "QSL of the Month" on page 6 for colorful and imaginative examples of these.

QSO—Conversation. "Thanks for the QSO, Old Man."

QSY—"Shall I change frequency? Change frequency." "Let's QSY up 5 kHz."

QTH—Location. "My QTH is Peterborough, NH."

QRX—"When will you call me again? I will call you at (hours) on (kHz)." Our QRX column is devoted to Amateur Radio news.

QRT—"Shall I stop sending? Stop sending." "The phone's ringing, I must QRT."

JUST PLAIN JARGON

What's a language without fun words and endearments? Following is a list of a few of ours. (Again, most descend from the CW-only days.)

DX—Long Distance

On HF this could mean contacts outside a ham's own country, but on VHF/UHF DX could be the next county.

OM—Old Man

Man of any age.

YL—"Young Lady"

Unmarried woman of any age.

XYL—"Ex Young Lady"

Wife.

Harmonics—Children of the OM and the XYL.

88s—Hugs and kisses.

And lastly. . .

73s—the very best to you! Enjoy our magazine!

Editorial Offices
WGE Center
Peterborough, NH 03458-1194
603-525-4201

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73 AMATEUR RADIO

JANUARY 1988 Issue # 328

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FEEDBACK . . . FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 96. You'll notice a feedback card number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

Cover Photo: Compliments of NASA. Astronaut Bruce McCandless II, a 41-B mission specialist, a few meters away from the cabin of the shuttle Challenger in a manned maneuvering unit using no restrictive tethers.

NEVER SAY DIE

Wayne Green W2NSD/1

THE WAY WE WERE

You aren't any more anxious than I for *73* to get back the way it was a few years ago—when the fast growth of FM and repeaters were a bonanza for the ham industry, providing the advertising it takes to support a fatter magazine. The formula for this is simple—magazines have to run abut 50% advertising to survive. Thus, for a 200-page magazine we need a hundred pages of ads.

If you'd like to see *73* back the way it was with 200-page issues, you can have 'em. The advertisers are looking for your business, so they're putting their ads where they hope you'll see them. In a perfect world advertisers would always make sure they knew where their orders were coming from and run their ads where they would bring them the most business.

What's actually happened is that the easy way out is to run ads in *QST*, since they have the most subscribers. Companies which can survive on the business they get that way do—the others gradually fade away.

It should not come as a news flash to you that the readership of the four ham magazines don't overlap 100%. The *QST* readers tend to be older hams, hams who already have their ham gear and are living on retirement incomes which keep their purchases of new equipment low.

CQ is read by the contest oriented hams, who are generally more interested in contests and certificates than buying ham gear. They're good for an occasional mammoth antenna system, the better to blow away the pileups.

Ham Radio interests the engineers with its complicated construction projects and in-depth engineering articles. These chaps prefer to build their stuff, which is fine for parts sellers, but of less value to equipment manufacturers.

73 is aiming at making amateur radio more fun for the active ham—particularly the ham who's interested in new modes and technologies. I pioneered single sideband in the 60s—then slow scan television. When I saw the potential for repeaters I pushed hard with hundreds of articles, book after book, repeater seminars around the country and a special FM repeater magazine. It worked, making repeaters the #1 ham activity. . .and all this with virtually zero help from any of the other ham magazines.

I started *73* back in 1960 because I felt there should be one ham magazine devoted to making ham radio fun. I concentrated on simple construction projects and covering new technologies. *73* was the first with nuvistors and pioneered the ham use of transistors. When ICs came along I published articles on the basics which were later reprinted in book form for computer hobbyists.

73 was first with computer articles. The ham enthusiasm for computers was what got me to start *Byte* magazine . which went on to *Microcomputing*, *80-Micro*, *In Cider*, *Run*, *Hot CoCo*, *Desktop Computing*, *Micro Industry*, *Selling Micros* and so on.

Between the lack of newcomers in our hobby (a 10% drop per year for the last few years)—the enervating effect of the low sunspots and a lack of new communications modes, hams haven't been buying as much equipment and this has been reflected in a drop in advertising which has thinned all the ham magazines.

The ham manufacturers and dealers will advertise where they think it brings them the most business, so if you mention *73* when you contact them, you'll see *73* growing again. If you don't they'll assume *QST* brought the sale and you'll have more exciting club news and section reports to read.

One way to make a difference is to rip out the *73* reader's service card, circle the products you're in-

Continued on page 18

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRM

Editorial Offices
WGE Center
Peterborough NH 03458-1194
phone: 603-525-4201

Advertising Offices
WGE Center
Peterborough NH 03458-1194
phone: 800-225-5083

Circulation Offices
WGE Center
Peterborough NH 03458-1194
phone 603-525-4201

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. A premium will be paid for accepted articles that have been submitted electronically (CompuServe ppn 70310,775 or MCI Mail "WGEPUB") or on disk as an IBM-compatible ASCII file. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts

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QRX . . .

EDITED BY BRYAN HASTINGS KA1HY

VEC Scandal

Recent events have blemished the VEC program. In an unprecedented action, the FCC notified all Volunteer Examiner Coordinators (VECs) with amateur radio operator testing teams in the Caribbean that it will no longer accept the services of any accredited volunteer examiner in VEC Testing Region 12. All amateur testing operations were ordered suspended last October amidst suspected licensing irregularities in that region.

John B. Johnson W3BE, Chief of the FCC Personal Radio Branch, cancelled the accreditation of all Region 12 VEs "because of widespread irregularities in the VEC system in Puerto Rico. . ." The action was taken in accordance with Part 515b of the rules which permit the government to decline the services of volunteer examiners certified by a VEC.

The FCC has been concerned with events in Puerto Rico for a long time. Ray Kowalski, Chief of the Special Services Division, cited at the 1986 Conference of VECs in Washington, DC in August that pass rates in Region 12 are abnormally high. While the total number of individual US amateur radio operators increased by less than 3½% since January 1986, the Puerto Rican amateur census during the same period is up nearly 50%.

On October 5, 1987, the FCC asked all region 12 VECs to determine if previously approved examiners should be reaccredited. "Those VEs whose performance is suspect should be dropped from accreditation. . .only those VEs in whose integrity you have absolute confidence" should be accredited, Johnston said.

Both the ARRL and the W5YI VEC programs notified every VE in Puerto Rico of their separation from the program.

The FCC has active ongoing investigations concerning suspected fraudulently-held VEC system test sessions in Puerto Rico. The Extra-Class VEs could face license revocation proceedings. There are several involved.

The Novice test program in VEC Region 12 is unaffected, however. They are tested under a completely separate program.

Canada-DA-DA!

The Canadian Federal Department of Communications announced the signing of an amateur third-party and reciprocal operating agreement between Canada and the USSR. This historic agreement became effective on November 1, 1987, and will be in existence until after the conclusion of the expedition next year.

The "Polar Bridge" USSR/Canadian ski expedition will cross the North Pole from Severnaya Zemlya to Cape Columbia on Ellesmere Island beginning in February 1988.

Guy Roy, a Radio Inspector for the DOC in Ottawa, stressed that this agreement applies *only* to the polar trekkers and the people authorized to contact them.

PRB-1 Challenge

In 1985, Boulder County Amateurs believed they had won a major victory in the battle for effective antennas when the county specifically exempted Amateur installations from the definition of a "telecommunications element" under the Boulder County Comprehensive Plan. The Plan even states that "Amateur antenna installations shall be exempt from height restrictions."

Boulder County hams Doc Evans NQØI and Tim Holzheimer N6DIY, applied for building permits to erect 125-foot antennas in a rural residential subdivision of Boulder County early last year. Because their towers would be base-fed, their entire installations can properly be termed antennas, and so fall completely within the no-height restriction definition given in the Plan above. Therefore, they didn't believe they needed to apply for a variance to the County Zoning Resolution—derived directly from the Plan—which limits the height of structures in the County to 35 feet.

Robert Helmick, the County Zoning Administrator, saw matters differently. Even though the towers themselves were also *active antenna elements*, he deemed them *structures* (all installations which are not amateur antennas), and so are limited to 35 feet. He also stated that PRB-1 did not apply in this case, since he interpreted PRB-1 as meaning that "local governments cannot prohibit amateur activity, but that they are free to impede amateur activities."

Local hams are taking this issue to the Federal District Court. If a case like this is allowed to stand, it will set a dangerous precedent to all other local governments in the country. The Boulder Antenna Fund desparately needs money to take this clear-cut case to court. They have about $7,000, but they need at least $15,000 to retain the required legal fees. Please send donations to:

Boulder Antenna Fund
c/o Barbara McClure NØBWS
5338 Spotted Horse Trail
Boulder CO 80301
(303) 530-1872

EME Records

Early reports suggest a number of significant records were established during the EME weekend of October 17. In one of the highlights of the event, a group of amateurs operated the 140-foot polar mount dish at the National Radio Astronomy Observatory at Greenbank, West Virginia. There may be a new world record for 13cm DX. According to ZL1AOX, ZL2AQE in Wellington worked Greenbank via the *moon* using 5 to 6 Watts and a 4-meter dish. A 10-GHz link between Greenbank and Italy was also to be attempted.

Phantom Phones

"Phantom dialing" in some cordless telephones is playing havoc with the phone system nationwide. Emergency services in several localities have now documented the self-dialing antics of wayward cordless phones. Santa Clara County, California has been logging 30 or more of these phantom calls a month for some time, and a suburban Chicago emergency switchboard director said that his operation receives about a dozen of these calls every 30 days. In most cases, the phones seem to dial simple numbers, such as 411 information, 611 telephone repair, or 911 emergency services. There are documented cases, however, of cordless phones self-dialing long-distance, and even international numbers, much to the surprise and chagrin of their owners when they receive their monthly telephone bills!

A spokesman in the cordless phone industry said that they know no exact cause for this phenomenon, but weak batteries and interference from other sources are distinct possibilities. Keep this in mind the next time you get a call with silence at the other end of the line!

Sahara Stint

The fall DXpedition to the Western Sahara was both an operational and political success, according to DXpeditioners OH2BN and OH2BU. The Lynx Group DXpedition reports over 11,800 QSOs during their stint as SØRASD. This includes 900 contacts to Japan alone! The initial operation concentrated on 20-meter SSB, which then moved for a spell to other bands, including 160 meters. Due to a limited power supply, and other training and social commitments, 24-hour/day operation wasn't possible. Mr. Namma, the Director of Telecommunications for the Western Sahara, proved a very pleasant surprise. He surprised everyone with his natural talent for on-air operation. Namma is fluent in Arabic, French and Spanish, and knows enough English to handle a QSO. It's reported that he will soon be on the air as SØ1A, to help keep amateur radio alive in the region.

Credits

Thanks for this month's news items go to *Westlink*, *W5YI Report*, CRRL, AMSAT, and the Boulder Antenna Fund Committee. Keep your news items rolling in!

Working the World—FAST!

Taller than the dome of the United States Capitol, W6GO's tower is the most striking tool in the DXing kit that won the Golden Jubilee DXCC Award #1.

by Leon Fletcher N6HYK

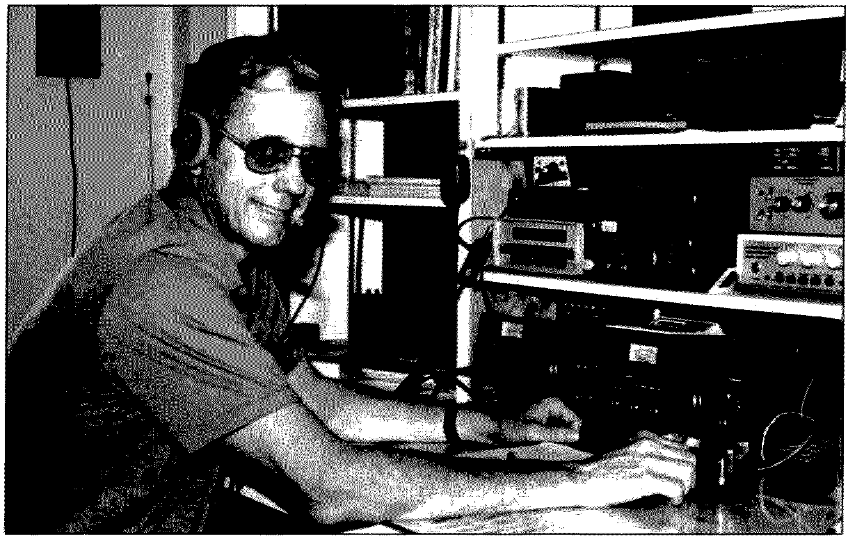


Photo A. "The first time I connected my new (158-foot) tower to this rig and sent a CQ, Europeans didn't stop calling me until the band went out late that night," says Jay O'Brien W6GO.

In the first 2 days and 42 minutes of 1987, Jay O'Brien W6GO of Rio Linda CA, worked 100 DXCC countries—an achievement that brought him an impressive trophy, enthusiastic acclaim by many fellow DXers, and the awe of countless tenderfooted DXers like myself. How could he have worked so many countries so quickly?

Many hams operate for weeks, sometimes months, even years to contact that many countries. If there had been a worldwide DX contest on the air, then working 100 countries in just over two days would not have been too difficult—but there were no such events.

Clearly there is a lesson to learn from Jay: If the rest of us knew how he works on the air, then we should be able to improve our operating skills, make better use of our gear and our time, and thereby increase the number of DX stations we work.

To get such inside information, I spent several hours with Jay in his shack. I watched him operate, studied his logs, drooled over his gear, asked him about techniques which might make me—make all of us—better operators. What I learned may well surprise you.

Go for the Gold

To fully appreciate what can be learned from Jay, we should start by looking at his achievement. His motivation was, of course, to earn the DXCC Golden Jubilee Award, an attractive certificate offered by the ARRL to all hams who worked 100 of the DXCC countries during 1987.

"My goal was to work 100 countries in 48 hours," Jay said. "Since the affair started late on a Thursday afternoon in California, I figured I had to have my paperwork in the mail on Saturday, so it could be delivered to the League headquarters in Connecticut on Monday. If it got there later than that, I'd probably not be among the first."

According to *The DX Bulletin*, Jay was first. In recognition of his skills, that publication presented him with a special trophy—a four-inch, gold-colored, metal figure in the shape of a number 1.

Jay is proud of that award, but he wonders. "A couple of other hams, maybe more, I've been told, may have done it faster. But apparently I was the first to do it and get the paperwork in."

According to the ARRL itself—which dated its certificates but did not number them, or note the length of time required to work 100 countries—four DXers were awarded the same day, January 5. They are AA2Z, Mark Wilson of East Hampton CT; K1MM,

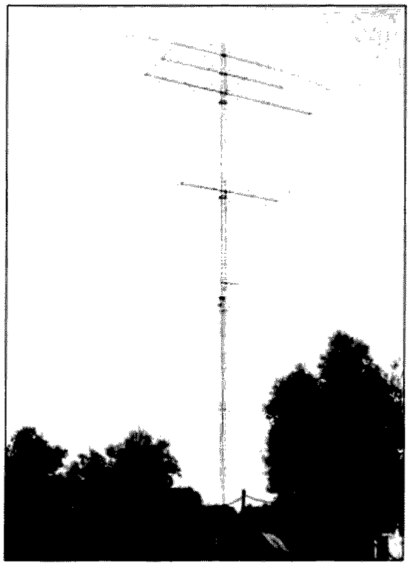


Photo B. Although taller than a 14-story building, W6GO's tower appears shorter because of the limitations of photography and the absence of other structures for comparison.

William Poellmmitz, Farmington MA; K6AAW, Larry Murdoch, Red Bluff CA; and Jay.

Of the 100 countries Jay contacted, 48 were worked by CW, 52 by phone. Forty-nine countries were worked on 20 meters, 32 on 40, 12 on 80, and 7 on 15. All told, he made 233 contacts.

"The best" of those contacts, Jay says, were BY (China), 9Q (Zaire), BV (Taiwan), C2 (Nauru), H4 (Solomon Island), 3D6 (Swaziland), ZD7 (St. Helena), and 3D2 (Fiji). That last one, Jay's log notes, was "8-9 Watts, Honda Accord parked."

Jay began his run for 100 countries at 0000 UTC January 1, and contacted 38 countries by the time the bands closed around 0900 UTC (2 AM local time). After about 5 hours of sleep, he was back at his rig at 1407 UTC (just after 7 AM local) and operated until 1036 UTC (3:36 the next morning); after that stretch of about 20.5 hours he'd contacted 87 countries. Then he took another 5 hours rest, returned to the air at 1554 UTC (just before 9 AM local) and at 0042 UTC (5:42 that afternoon), worked PA3DKU (Netherlands) to complete his 100 contacts.

In working those countries, he used a varied array of what might well be called tools. As we look at them, you might consider each as a checkpoint for possibilities to upgrade your own QSOing.

The Tools

Tower: This is the most striking tool in Jay's DXing kit. The tower is 158 feet high. Viewing such a height from the ground, it is difficult to comprehend the loftiness of that tower. Nearby are several trees approximately 30 feet high, but they are far too short to make meaningful comparisons. As I looked upward from a short distance away from the tower, the linear loaded 80-meter dipole, mounted 153 feet up the tower, looked more like a toothpick than a 90-foot element.

But the tower is taller than a 14-story building; taller than the dome of the Untied States Capitol; taller than the Statue of Liberty.

Photo D. Jay holds the gold-coated "#1" trophy presented to him by The DX Bulletin attesting to his working 100 countries in 2 days, 42 minutes.

At the 72-foot level of the tower there is a rotating joint; thus, the top 86 feet of the tower can be turned. The structure is mounted on a cubic meter of concrete. The four sets of guys—at 42, 72, 106, and 127 feet—are anchored in three cubic meters of concrete, set 130 feet from the base.

The tower and antennas were set in place by a helicopter in just a little more than three hours. "It took longer than that to edit our videotaped recording of the entire operation," says K6HHD, Jan O'Brien,

Photo C. W6GO points to his Golden Jubilee certificate dated on first day of the award.

Jay's wife and another prominent DXer.

The structure is located close to the center of a 10-acre spread. The coaxial cables from the antennas to the shack run just under 500 feet. "That's not really too much of a run," Jay says, "What little is lost is more than made up by what's gained from the height."

Antennas: In addition to the 80-meter dipole, the tower supports a 40-meter, four-element yagi at the 147 foot elevation; a 20-meter, six-element yagi at 140 feet; a KT34XA tribander at 106 feet; and a 160-meter half sloper, which is fed at the 75-foot level, just below the rotator.

The Shack: Compared with whatever might be the typical ham shack, Jay's is a mansion—in size, equipment, furniture, and layout. The actual operating position is relatively modest: about an 8-foot custom-made table and shelves with white Formica-type tops, on which sits an impressive array of gear. But the station is less than ten percent of an entire. . .well, *arena* devoted to ham-related activities.

They take place throughout most of a double-sized living room, dining area, and two reception foyers. Spread out on tables which are along the walls of the rooms are three computers a dot-matrix printer, a laser printer, three daisy-wheel printers, a specially-designed printer for mailing labels, modems, and much more—with a maze of cables and switches so all can interconnect in any combination.

To work—or to contemplate—all this equipment, and to accommodate guests, there are enough luxurious sofas, stuffed chairs, recliners, and such (with a charming wood-stove set in the middle of the layout) to seemingly equip a modest furniture store. Clearly, the O'Briens enjoy combining hamming with living well.

Gear: To work the world, Jay uses two transceivers: ICOM's 751 and 730. Adjacent is an imposing mass of equipment: to select antennas and rotate the tower, to determine beam headings, to monitor signals—plus far more gear that I felt motivated to list or to question.

One of the key elements in Jay's successful operating is an amplifier, an Alpha 76PA, 1,500 Watts output. It's a key unit because of his interesting—offbeat—attitude toward using amplifiers. He says, "I know a lot of hams—maybe most hams—say amplifiers add to interference on the bands. I don't think that's true. If I operate 1,000 Watts, I'll usually make just one call and have my contact. If you operate at 100 Watts, you often have to call up to ten times to make your contact, and those extra calls produce more QRM."

Listening: Of course you've read and heard of the value of this basic tool in virtually every manual, handbook, tipsheet, guide, course, forum, whatever, concerned with operating skills. But apparently Jay was born with-or has developed-especially alert and sensitive ears. During one animated discussion amongst him, his wife, and I, he heard a 2-meter call for his wife when neither she nor I had heard anything at all on the air. Later, when checking the bands to demonstrate his gear to me, he'd barely pause on a station, yet he'd hear the station's call completely, correctly, the first time it was given, even calls down around 2x2.

Calling CQ: "This is more effective than many hams realize," according to Jay. "If no one called, no one would make any contacts." He got most of his 100 countries by calling "CQ". He didn't have to call repeatedly; pile-ups would often develop quickly as

Photo E. Based on logs such as this, Jay sent some 5,000 QSL cards during the first half of 1987 alone.

his strong, clear signal attracted, at times, more stations than is ideal for quick and easy reading. Then he'd move off, sometimes changing both band and mode.

It's also wise to call CQ every now and then on a band that doesn't seem open—where there are no signals to be heard, or very few. Especially on 10 meters—that's opening more and more these days, and it's also open a lot more often than many hams realize; they just don't send out CQs to find out."

"his" and "my" signals reports, frequency, and name of the hams he works. For this chase of 100 countries, he entered an extra notation; a number in a circle to indicate how many countries he'd worked.

Watching Jay away from his operating position also reveals his efficiency. As soon as he cued up the 40-minute videotape of the raising of his tower, so I could view the event, he immediately moved to a computer to work without interruption until I'd finished viewing the tape. Then, as we walked outside to talk about his tower, he moved a couple of lawn sprinklers without breaking the story he was telling. When I drove away from our visit, I glanced back and saw that before I'd left his property he was already at watering another plot.

"I watched him operate, studied his logs, drooled over his gear."

Persistence with Flexibility: One application of this tool is Jay's staying on a frequency when it is productive—bringing in new countries—but moving at a timely moment to another frequency, even another mode.

His log shows that during the first morning he sent a CW "CQ" on 14,017.3, made 16 contacts, picked up five new countries (numbered 46 through 50) in 37 minutes. But during the last 15 minutes no new countries were worked, so he shifted to 15 meters phone and contacted 6 additional countries in the next hour. Later, in one 2-hour period on 20 meters, he worked 9 countries, but added only 2 new ones, so he shifted to 15 meters and in just over an hour-and-a-half made a run of 9 new countries (numbered 62 through 70) when new ones for his list were becoming scarce.

Efficiency: Watching Jay operate, you'll notice there's very little wasted motion, effort, or time. He logs in standard 6"x9" secretary's shorthand notebooks, the ones with green pages and a spiral ring at the top. His entries are neat, easily readable, written in six columns, unlined yet straight as marching soldiers. He logs in this order: time, call,

Another sign of his efficiency: he sends his QSLs to all DX stations soon after he works them, rather than waiting to receive cards from them. "I've found that saves me a lot of time and effort. By sending cards to everyone, when I get a stack of cards in the mail, I don't have to bother to look up in my log the details of the contact. Also, it helps satisfy the demand for California QSLs for those overseas DXers who are chasing the awards offered by the California DX clubs."

His QSLing is made easier by the *QSL Manager List* he and his wife publish monthly. It is a computerized listing of more than 5,000 QSL managers. Many hams consider it the most accurate source available on where to send your cards—you can get confirmations from DX stations considerably faster than by going through bureaus.

Experience: Jay began hamming in 1949. He has worked 320 countries, all confirmed except VU4 (Andaman and Nicobar Islands). He is on the DX Honor Roll at the 308 level. Above his gear is a display of 17 plaques, including 5-band WAZ and 5-band DXCC, 1983 DXer of the Year of the Northern California DX Club, and a variety of honors for his frequent entries in contests.

His related experience includes 30 years with Pacific Bell (Telephone), from which he retired a few years ago as a project manager. He continues to work occasionally as a consultant in the project management field, RFI, computer problems, and other communications-related fields.

Jay's experience has also helped to build his apparent concern for people. Despite his eagerness to work 100 stations as fast as he could, he still took time to log the names of his contacts. He also took time to note some interesting bits of information: "Just about to graduate from high school," "Near Paris," "Gold Coast city," "Boy Scout," and such.

An unknown wordsmith said, "The difference between men and boys is the price of their toys." Jay is one man with expensive toys—but he plays with them very well indeed. A great many hams can learn much-improve their DXing-by following his lead.

Leon Fletcher N6HYK lives at 274 Webster Drive in Ben Lomond CA 95005. He is a prolific author of books and articles as well as professor emeritus of speech at Monterey Peninsula College.

This tower, taller than the Statue of Liberty, required a helicopter to lift the top 21-foot section into place.

Brian D. Smith KA9OIH

Fostering Goodwill and Great DX

W87PAX operations at the Pan American Games.

In early August of '87, I embarked on a solo DXpedition to the land of the world's rarest prefix. Starting on the west side of Indianapolis, I spent a solid half-hour navigating my 1972 Pontiac across concrete trails that pierced the heart of the city. At length I wound my way to an eastside neighborhood, onto a short side street and into a grassy field, where I abandoned the vehicle; the rest of my journey would have to be covered on foot.

Alone and unarmed, I trudged through grass and gravel for what seemed like minutes until—there it was! Rising up in front of me was my destination—a five-room, white building surrounded by several lofty antennas.

Yes, it's true: For 23 days in August, this tiny spot in the middle of W9-land was, literally and figuratively, the home of the world's rarest prefix—also known as special-event station W87PAX.

This operation, with which I am proud to have been associated, began as an organized effort to commemorate the Tenth Pan American Games in Indianapolis. But by the end of its meteoric life, it had, in the opinion of many, blossomed into the most successful special-event operation of all time.

That's a bold statement, of course. But W87PAX racked up some pretty bold statistics.

"I was in the Magic Kingdom of DX Disneyland."

Operating almost nonstop from August 1 to 23, the station logged more than 23,000 QSOs in 139 countries. Our 44-member crew placed up to nine transmitters in simultaneous operation, used six modes (including ATV) and conducted QSOs on 13 frequency bands between 160 meters and 1296 MHz.

As a result, we are claiming nine all-time records for a special-event station.

But numbers alone don't tell the whole story. Our totals notwithstanding, we never intended to mount an operation based solely on the ledger sheet.

Naturally, we savored the ever-rising QSO count and the smorgasboard of scarce DX that, for once in our lives, was chasing us. But believe it or not, our bottom line was simply to have fun.

In the process, of course, we generated excitement in the world radio community, attracted national and international news coverage of ham radio and spread goodwill from the city of Indianapolis across the entire world.

There were other highlights, too. We received and delivered about 300 messages to and from Pan Am personnel. We helped arrange a third-party agreement between Washington, DC, and the island of Aruba. And above it all, we had the time of our lives on the airwaves.

So much for summaries. A story of this magnitude is properly told in sequence, so let us turn back the logbooks and return to the very origin of W87PAX...

The Way We Were

Our tale begins a few years ago in a continent far, far away. It helps to know that Santiago, Chile, originally owned the right to stage the 1987 Pan Am Games, a multisport event for athletes in the Western Hemisphere. But political unrest and a lack of funding prompted the Chileans to relinquish the Games in 1983.

Photo A. The main operating station at W87PAX, which amassed 13,632 QSOs on 20 meters.

Next in line was Ecuador, but in November 1984, that nation bowed out, too.

With time growing short, the Pan American Sports Organization (PASO) met in Mexico City to select a new host. Havana, Cuba, and Indianapolis were the only bidders; both came out winners. PASO awarded Indianapolis the 1987 Games and Havana 1991 Games.

Meanwhile, back in the Hoosier capital, ham radio operator Kurt Pauker, KT9M, heard the news and saw an opportunity. Pauker believed that the Games, which are second in scope only to the Olympics, deserved a special-event station of the same magnitude.

He wasted no time in buttonholing the local Pan Am Committee, PAX/I (Pan American X—Roman numeral for 10—Indianapolis).

"He said that we've just got to do a big station," recalls Mike Koss, W9SU, who furnished the shack for W87PAX. "He went to the committee and told them he had everything organized, that he'd gotten a bunch of guys and a station.

"Actually, he hadn't told anybody," says Koss. "But the Pan Am Committee said go ahead. So he called me. 'Guess what we're going to do? We're going to do it from your place,' he said."

The first step was to obtain an appropriate call. "The FCC would not authorize us a special license per se," says Koss, "but they were willing to consider modifying an existing callsign."

They search the *Callbook* for the right combination. Since the station would be in Indianapolis, their goal was to borrow a 9th Area callsign with PA in the suffix.

Surprisingly, the first couple of amateurs they contacted turned them down. Organizer Mike Head WB9ZQE then contacted W9PAX, Gordon Miller, an Advanced Class operator from Wisconsin Rapids, Wisconsin.

"We called him on the phone," says Koss. "He was quite enthusiastic about it. I think he was kind of honored."

With the W9PAX call in hand, they went for broke. Undoubtedly, a special, FCC-approved callsign would add zeros to the QSO total. But the Feds hadn't done that number since the 1984 Olympics.

Twice, the organizers petitioned the FCC for permission to modify the call to W87PAX. Twice the FCC said, no. "We still didn't want to give up on it," says Koss. "So we contacted them by telephone. After careful explantion and negotiation with commission officials, they were willing to make the exception."

The official word arrived in a telegram from Michael Fitch, chief of the FCC's Private Radio Bureau. Fitch noted that the approval of one petition "tends to result in a proliferation of such requests."

"However," he added, "due to the international nature of the Games, the participation of athletes from virtually the entire Western Hemisphere and the predicted large number of spectators, we believe that a waiver of the callsign requirements is in the public interest and therefore warranted."

Photo B. After their successful effort ended, many of the 44 operators of W87PAX assembled for this "team picture." Note the lofty antenna in the background.

Photo C. W87PAX operators Chuck Mitchell WB9NWF (at left), and Brian D. Smith KA9OIH (the author of this article), sit at the main operating station.

(A discouraging note to all special-event organizers who would follow in our footsteps: Don't count on it. Before you flood the FCC with similar requests, remember that the Pan Am Games involved 38 nations. The sad truth is that unless your event is also international in nature, chances of obtaining a special call are virtually nil.)

W87PAX organizers had publicized the operation in amateur radio magazines, but they took no chances. Just in case their efforts fell through, all notices mentioned both calls—W9PAX and W87PAX. Either way, the station would operate from 0001 UTC August 1 to 2359 UTC August 23.

W9PAX went on a couple of trial runs on Field Day and in late July. On the last day of July, less than eight hours before air time, Koss received the news we'd been waiting for: temporary permission to use W87PAX. Success was assured.

On the Air

When word of the special callsign arrived, "We immediately rushed to notify all the operators," Koss says. They correctly anticipated that all Hades would break loose once the first CQ from W87PAX crackled across the well-publicized frequencies.

Midnight tolled in Greenwich. "At that point, we had all six stations ready to go," says Koss. "Like the flying start at the Indianapolis 500, at 0001 UTC, Kurt yelled, 'Go!' and everybody jumped in."

It's a wonder the ether survived. "There was a pileup on every band, even on VHF,"

Koss notes. Eighty meters, 40, 20, 10, 6 and 2,...at every stop, stations were piled higher than the F layer.

WA2DTN nailed down the first QSO. Others rolled in like a tidal wave. "We worked 3,000 stations the first day, and 5,000 by the end of the weekend," Koss says, "There were 50 straight hours of pileups; we had over 100 QSOs an hour.

"It was like being DX without leaving home."

DX Dreams

For me, the dream is always the same. In reality I'm fast asleep, but in my imagination I'm sitting behind the microphone of my home station, frantically trying to direct traffic as the rarest DX on the planet chases KA9OIH.

"The BY1 station—I SAID, 'PLEASE STAND BY!' The 1S1, you're 5 and 9! Albania, you're next!" Then comes the inevitable buzz of my alarm clock.

But when my turn came at W87PAX's 20-meter mike, the alarm clock was silent. The dream was real.

My seventh QSO was a 3A2 who fought his way through my pileup. Later, in the span of 40 minutes, I worked a poker hand full of 5's—a 5H3, a 5L2, a 5N8, and 5V2 and a 5B4. There was a VK9, a 7X2, a ZB2...my head was reeling. I was in the Magic Kingdom of DX Disneyland.

This is the sort of experience that gives one incentive to lead a good life. Perhaps someday, when I become a silent key, St. Peter will show me the way to that great ham shack in the sky, where all the pileups are deep and all the sunspot counts are above average.

Higher and Higher

Despite generally disappointing conditions, our QSO total reached 10,000 after the first week and 17,000 after the second.

One of the secrets of our success was the certificates we dangled before the eyes and ears of our fellow hams. Work us once for a QSL card, we said, work us on three bands for a certificate.

That proved to be a stroke of genius. Instead of one QSO and goodbye, stations were trying for three. Some couldn't even stop at that point. "I've worked you on five bands now," one ham boasted. And so it went, as multiple QSOs with W87PAX became a status symbol.

"A lot of this has to do with understanding low-band mentality," says Koss, "These people like certificates, special callsigns, fancy QSL cards. That's the thing that drives them in the hobby. Offer them that and you can't lose."

Meanwhile, we accommodated—and even cultivated—the media's attention. We'd already found ourselves in USA Today and on local television, but why give up there?

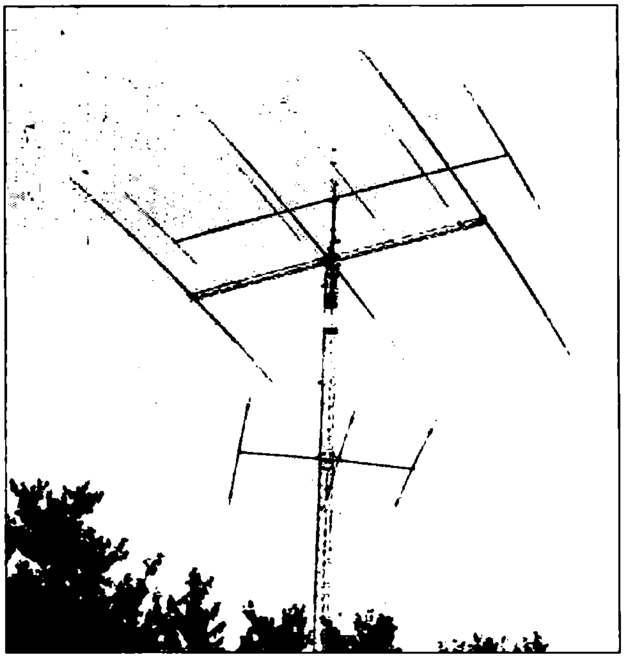


Photo D. One of the four towering antennas at the ham shack of Mike Koss W9SU, which was used for the W87PAX operation.

My eight years as a journalist had taught me how to, and how not to, write a news release that will catch an editor's attention. So I whipped up a punchy release that we photocopied and sent to the local media. That prompted even more coverage.

Meanwhile, back in the shack, spirits soared. We manned the station virtually around the clock, and as word spread of our operation, others wanted to enlist.

For example, after working our station, Ron Weiss W9OFF, asked if we needed any more operators. Sure, we said, come on down. Weiss and a friend, Chuck Mitchell WB9NWF, proved to be dedicated reinforcements.

Besides instigating pileups, we found time for public service. We learned that messages from our Pan Am visitors were not being delivered to their home countries (chiefly South and Central American nations) because of a snafu.

The existing traffic system, it seems, could not easily handle messages in Spanish. With our respectable array of antennas—four towers between 90 and 140 feet—we figured the shortest distance between two points was a straight line. So, without prior planning, we organized a daily Pan American net and encouraged check-ins from our ham radio brethren in South Central America. Their enthusiastic assistance enabled us to deliver dozens of messages in short order.

Once, we found ourselves dabbling in international relations. Officials from the island nation of Aruba had become ensnared in bureaucracy when they called Washington, DC, to negotiate a third-party traffic agreement for the Pan Am Games. The request filtered down to Aruba's amateurs, who heard our Pan Am commemorative station on the air and decided to give us a try. On behalf of Aruba, we contacted the FCC, which in turn forwarded Aruba's request to the State Department. A third-party agreement soon followed.

No mention of our special event would be complete without recalling how much confusion our unique callsign caused among the uninitiated. The best line came from the Novice who insisted we were mistaken about our call. "Check your license again," he told us. "It's probably W-B-7PAX."

SK for W87PAX

The swansong of W87PAX floated across the airwaves shortly before the unrelenting Latin beat of Miami Sound Machine enlivened the Games' closing ceremonies. Our temporary license was to expire at 2359 UTC August 23, so in our final hour we activated every station, staging a final burst of comet-like brilliance before disappearing forever into the haze.

In those waning moments, I found myself CQ-ing at the key of our 40-meter rig. Strangely, QSOs were scarce. At 2355, I answered the call AA4IO with a quick "599" and flashed a "QRZ?" But there was no response.

The Koss entered the room and told me to QRT. AA4IO returned with another question, asking my name, as I recall. "Brian," I replied, "SRI—MUST QRT. 73. AA4IO DE W87PAX SK."

Feeling depressed, I switched off the rig and stood up. Suddenly, the station sounded like a library. Fellow operators milled around, saying little. The atmosphere was subdued.

Koss had ordered enough Chinese food to feed the People's Army, so we formed a line and filled our paper plates with "BY" cuisine.

Sitting on the porch, we heard news of our whopping QSO count—23,270—and celebrated briefly. Then it was time to go. We clasped hands, exchanged congratulations and murmured our farewells.

Darkness engulfed me as I walked down the driveway toward the W87PAX parking lot. Headlights appeared behind me, and as I turned around, I heard the voice of Koss's non-ham neighbor. Even he had heard of W87PAX.

"Hey," he shouted through his rolled-down car window, "What are you guys gonna do next week?"

I chuckled and shook my head. "I don't know," I said, sighing, "I really don't know."

Brian Smith KA9OIH lives in Indianapolis IN 46260 (1742 Century Way/8) and is an editor with Indianapolis magazine and an avid DXer.

NEVER SAY DIE

from page 6

terested in and send it in. Only about 10% of the *73* readers have been using the card . . . tsk . . . and that's illegal and punishable according to the contract on page 6. I've been far too lenient about this so far.

Your reader's service card with some circles will make our advertisers very hapy—will make me happy—and, if you actually buy some gear, will result in *73* growing in size back to a big, fat magazine. When's the last time you made people happy so easily?

One more thing—while some advertisers go to a lot of trouble to see that you get the information you want, complete with ordering information, we have a few who haven't got their act together. I'd really appreciate hearing from you on how quickly your responses arrive, how helpful they are—and if they got you to buy something. Your feedback will help me get advertisers to do better. One of the most fun things in amateur radio is buying something new and getting it on the air.

In the meanwhile, if you can think of any way I can make *73* more fun—yes, I know, cut the editorials—let me know.

Not for Profit

In a recent ARRL newsletter I read the following, "It is obvious from the comments filed that the amateur community views the assignment of call signs as a service, and not as a business proposition, and amateurs would not be supportive on the appointment of a for-profit entity as a Special Call Sign Coordinator (SCSC). The Amateur Radio Service has always been non-commercial by its very nature, and as such it would be improper in the extreme to commercialize the assignment of call signs. Amateurs are certainly willing to pay the cost of services received, but not to the extent that a private-sector entity appointed by the Commission should profit from it."

Since, out of the twelve entities who filed petitions with the FCC, there seems to be only one non-profit entity other than the ARRL seeking to provide a national SC-SC service, the above comments would seem to be self- serving in the extreme. But let's take a look at the concept that's involved here.

Shortly before the American Constitution was written two hundred years ago Adam Smith published his *Wealth of Nations*. This book makes as good reading today as it did two hundred years ago. It's a manifesto for the entrepreneurial-capitalistic system —you know, the one the communists call decadent.

Having visited the USSR, China, Czechoslovakia and Yugoslavia, I can personally affirm what you've read—communism does not work—it has not worked for the benefit of the people in one single country. And that's the main difference between for-profit and non-profit. It's communism/socialism vs. capitalism. Has Karl Marx or Adam Smith triumphed in the test of time?

Let's look at non-profit as we have it in America. Well, we have our government, which certainly is a model of non-profit . . . we've the highest international debt in the world. I challenge you to point to one single government program which is run with any efficiency.

And we have our non-profit American educational system which is infamous for its protection of poor teachers and its resistance to change. It's also famous for turning out illiterates and bozos.

Non-profit corporations enjoy massive postal benefits, paid for by the for-profit corporations with which they compete. Non-profits have little restraint on lavish salaries and perks—and apparently no limit on the millions they can salt away in investments. We've all read about the millions siphoned from non-profit groups into mob enterprises.

The real strength of America has always been in capitalism . . . and its main weakness has been socialistic adventures. Yes, they're always well-meaning—that's the apology for these unending failures.

If we get a non-profit SCSC group to issue our calls it seems unlikely that we're going to see the first known efficient non-profit organization. What we'll see is what we always see when we deal with bureaucrats—inefficiency, bungling, arrogance and frustration for us. The few intelligent people I've met working for our government or non-profit corporations are hopelessly trapped by systems which defeat their intelligence. Few people with intelligence or creativity last long in these maddening situations. They soon discover they'll never make much money, they'll never be able to make decisions without the fear of damaging their careers—that creativity is a cardinal sin. So this is what amateurs are demanding to run the SCSC service?

I wish every amateur who honestly believes that he is going to get a better and cheaper service with a non-profit than with a for-profit group running the SCSC program would visit the USSR—anywhere in the USSR! The total lack of interest in work which guaranteed employment engenders has to be seen at first hand to be really understood. We see it here at times when we have to deal with the government.

Have you forgotten your brush with our Employment Security Administration? Car registration? The military? Let's be kind and say that our bureaucrats are not as helpful as we might like. One gets the impression that government employment too often attracts tiny minds intent on doing the least amount of work necessary to achieve retirement.

Sure, there are exceptions, many of whom I know personally. But when I talk with the exceptions their stories of frustrations with the system in which they are trapped are sad to hear.

I'd far rather buy my call signs from a for-profit company which has to provide good, efficient and inexpensive service in order to keep its franchise.

Lordy, The Connecticut Turnpike was able to get rid of four toll booths (35c each) just by giving the food franchise at the rest stops to McDonald's. The result is incredibly better food than we had before, better service, a saving ol $1.40 tolls and no more pileups of traffic at the toll booths. Everybody won. This came to mind because I happen to be writing this as I drive along the Turnpike on my way back to New Hampshire from a most interesting adventure in New York City.

I want a for-profit company which is going to have a vested interest in providing good service—one which will be installing the latest in computers and communications, not bureaucratic forms and lifetime tenure employees.

I suggest that any amateurs who have written to the FCC or the ARRL (if any really did) pushing for a non-profit handling of call signs give the concept some serious re-thinking.

73 Review *by Pete Putman KT2B*

ICOM America, Inc.
2380 116th Ave. NE
Bellevue WA 98004
Price Classes: IC-475A $1400
AG-35S $95

ICOM IC–475A 70cm Multimode Transceiver/ ICOM AG–35S Mast-Mounted 70cm Preamplifier

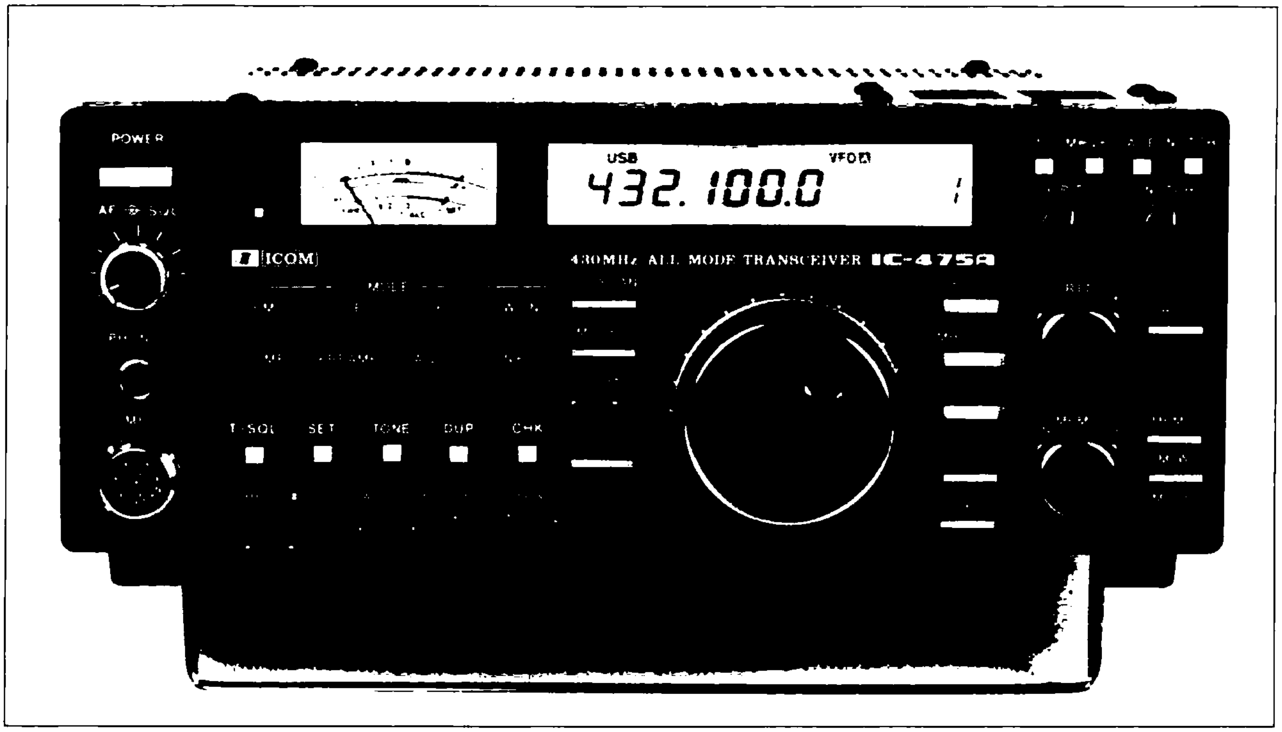


Photo A. Front view of the ICOM IC 475A, 70cm Multimode Transceiver.

Hard on the heels of the "new-look" IC-275A 2meter multimode comes ICOM's offering for the 70cm band, the IC-475A. Regular readers will recall the review of the 275A in the March 1987 issue. In it I commended ICOM for their innovative design as well as the outstanding performance of the receiver front-end and mixer stages. The IC-475A lives up to the reputation set by the 275A.

Overview

Let's take a look at some of the unique features of the evolving "75" line! First of all is the compact design with amber LCD display, resulting in a snappy-looking rig that fits into some pretty tight places. The case dimensions check out at 9.5" W x 3.7" H x 9.4" D (same as the IC-275A) allowing either mobile or base-station installation. The heat sink is mostly internal to the chassis, and in fact upon opening the top cover, that and a small speaker is all you see. Incidentally, all "75"-series radios come with a built-in AC supply as well as external connections for 13.8 VDC.

The front-panel controls have been engineered for easy access, with the more important ones featured prominently to the left and right of the display. Adjustments that don't require frequent adjustment are found under the left-side pushbutton panel and are push-actuated potentiometers. These control RF POWER, RF GAIN, CW DELAY, AF TONE, and MIC GAIN. Additional buttons here control the optional speech synthesizer, T/R switching, and meter display. Directly above these are the main controls for mode (FM, CW, SSB), speech compressor, AGC time constant, and noise blanker. Tone-squelch settings are activated from this pad, as are the repeater offsets and a repeater-reverse control.

The volume, squelch and power controls are to the right of this pad, while switches for tuning speed, MHz stepping, VFO selection and VFO splitting are to the right of the main dial. Beyond this are located the RIT controls, memory-command buttons, memory-selection switch, and passband tuning/notch adjustments. The control complement is rounded out with 3 pushbuttons immediately to the left of the tuning dial for scan mode, and a data switch, which I'll discuss momentarily.

The amber display is easy on the eyes and it reveals a lot of information as well. Not only is the frequency displayed on both transmit and receive, but the RIT control and its offset are shown as well as the offset (if any), VFO or memory position, and the mode selected. The equally visible meter to the left shows power output, ALC level, signal strength, and acts as a discriminator meter in FM mode.

Right away you might ask why anybody might need a notch filter and passband tuning on 70cm, as these controls would only be used working CW or SSB. Well, they do come in handy on occasion during a contest or when the band is open during strong tropo—otherwise, you probably won't need them. ICOM continues their practice of deleting a

VOX function from their multimodes and I say more power to them! The only thing approximating VOX here is the adjustable CW-keying hang-time, which offers both semi- and full break-in. (The benefit of full break-in CW here is questionable, as most serious 70cm CW types will run outboard amplifiers and none of the various brands I know of are presently equipped for QSK operation.)

Half of a Pair

Since most of the control functions were discussed in the March IC-275A review, I'll cover them very briefly here. Two VFOs are standard, as is a 99-channel memory bank. You may store information regarding the mode, frequency, offset, and any tone squelch settings in these channels. Uploading this information to either VFO is accomplished at the touch of a button. You'll need to do that to use the RIT control, among other things. Loading memories is just as simple! In addition, ICOM provides a Call Channel (read Priority Channel) and two channels designated P1 and P2. These latter channels define the upper and lower limits of a pre-programmed band segment scan mode.

> ***"CW operation? It's a breeze."***

What is the actual frequency coverage? Unlike the IC-275A which allows the user to listen in from 138–174 MHz, the IC-475A is limited to 430–450 MHz. That's it! This covers the current active 70cm spectrum in the US and Canada at present, and all possible modes are available—except Fast Scan ATV. This is unfortunate, since the companion IC-1271A for 23cm does offer FSATV, and it would make the transceiver more attractive to a larger market. Incidentally, one can run SSTV through the microphone jack, and ICOM also encourages AFSK RTTY operation.

The packet enthusiasts have been accommodated with the DATA switch I mentioned earlier. ICOM boasts of their high-speed switching time (less than 5 milliseconds) allowing both high-speed packet and full break-in CW. Select the DATA switch when running either packet or AMTOR modes to allow for that fast T/R switch time (no, it's not the default setting). You can use it in USB, LSB or FM mode. Apparently, packet on 70cm is quite popular over in Japan (in fact, packet on any band is popular there), so all of the '75-series radios have or will have this DATA switch and offer the 5ms keying time.

One last feature: There is a provision for a narrow CW filter as on the IC-275A, although it's not the same filter according to an errata sheet in the owner's manual. The correct filter is the FL-32A with a center frequency of 9.0106 MHz. This filter is a 500-Hz type with -6-dB skirts at ± 250 Hz and -60-dB skirts at ± 670 Hz. The band isn't that crowded during a contest on CW, but the EME operators will have lots of fun with this option, especially in conjunction with the notch and passband-tuning controls to home in on that weak echo.

Incidentally, ICOM has changed their amplifier keying contacts from the familiar RCA jack to an 8-pin DIN receptacle on the '75-series radios. It was a simple matter to make up an RCA-to-DIN jumper for the outboard amplifiers, once the proper DIN plug was located! This type of plug has tapered pins—not rounded, as most over-the-counter types sold in the US will have. If you try to force one of the latter types in, you'll do serious damage to the jack! Make sure you have the right plug. (It's the same plug used on the Kenwood TS-430/-830/-930 radios, by the way.)

In Operation

The receiver and preamp got a true field test. I took the IC-475A and the AG-35S to Chincoteague Island in June 1987 for the ARRL June VHF QSO Party. What better way to test it? The good news (and all the news is good) is that the transceiver worked better than I hoped!

This is the first contest in a long time that I've operated on 70cm without using a transverter and HF radio. Based on my experiences with the IC-275A (which was also undergoing a similar crunch test across the operating table), I felt that the 475A would pull its weight. The fact that we used two 21-element yagis ahead of it certainly didn't hurt matters.

Before I go further, I'll digress for a moment to the AG-35S. This was sold as a companion unit to the now-discontinued IC-471A/H series radios, but still uses the same DC-power switching scheme with the newer IC-475A. It uses a 3SK121 device in a waterproof housing and is rated at 100 Watts through-power capacity. I elected to use a Tokyo Hy-Power 70cm amplifier with built-in preamp after the IC-475A, but the AG-35S was put in the line between the transceiver and amplifier for comparison purposes. With a run of under 70 feet of Belden 9913 cable to the antennas, mast-mounting the amp was unnecessary.

ICOM rates the preamplifier at better than 15-dB gain with a noise figure under 1.5 dB. On-site observations were pretty much in agreement with that number. I wasn't in a position to measure the noise figure.

I can tell you with confidence, however, that the housing is indeed waterproof. The night before the equipment was completely installed, we were treated to one of the delightful Chincoteague thunderstorms, during the course of which one of the two support tents was partially flooded. In one corner of that tent lay the box in which the AG-35S and AG-1200S for 23cm were stored (of course), and they were discovered the next morning, merrily floating around in circles. Upon opening each unit, the internal housings were found to be bone dry. Satisfied?

Contest Contender

The September issue *73 Magazine* covers the contest. 432 MHz SSB and CW were fairly busy at times, and the IC-475A performed nobly, especially on weak-signal work. The IC-475A signal-strength meter suffers from the same malady as the one on the IC-275A: It's very sluggish. In separate tests on the bench, a 2–3-μV signal was required to register S-9. It moved hardly at all on most received signals (except when the external preamp was kicked in). The preamp made it possible to work grid squares over 300 miles distant with our modest station.

> *"The receiver is very quiet, a direct result of an efficient mixer and a well-designed front end."*

Received audio reports were acceptable and on a par with the IC-275A. Both transceivers offer crisp, punchy audio with the supplied hand-held microphone. (I didn't use any base-station microphones; rather, I used a foot switch to key the transceivers and the free hand to log and tune.) ICOM offers a speech-compressor option on the 475A, which helped considerably during contacts with very distant stations, providing the settings were correct. I suggest running the microphone gain at about 9 o'clock with the compressor ON for the best results.

CW operation? It's a breeze except, as stated earlier, most accessory amplifiers can't use the QSK option. You'll have to choose the appropriate drop-out delay with the front panel recessed control, and select the SEMI option on the back panel. Or, do as we did and opt for no delay time, using footswitches and the PTT line for keying.

One really handy feature on 432 is the RIT control, which offers up to 9.9 kHz of shift using a continuously-variable control. Despite all of the advances in phase-lock loops and high-stability crystal oscil-

lators, there are still an awful lot of signals on 70cm that slowly drift up or down from the initial contact frequency. During short contacts, you'd never notice it, but on repeated calls with some really weak signals, it is quite apparent. When finished, the RIT is disengaged by depressing the RIT CLEAR control, or by switching out of RIT mode altogether.

Survival of the Fittest

As an aside, the transceiver also survived, and is still doing well, after 3 successive nights of spectacular lightning displays, including a near-hit that blew up a nearby mobile amplifier and preamp. I should add that disconnecting the coax is highly recommended during such a storm! We did operate during some of the nearby (5–10-mile distant) thunderstorm activity with no adverse results. Finally, some overloading problems on the 475A were observed with the AG-35S preamplifier switched in while running 200 Watts on two-meters. We attributed this to the close proximity (within 7 feet) of the 70cm and 2m antennas.

Subsequent use during the CQ WW VHF WPX in July confirmed most of my observations from June. Many operators complained that the IC-475A had little or no front-end sensitivity, attributing the "quiet" front-end and mixer noise to a sub-par GaAsFET device. Well, the receiver is very quiet, a direct result of that same efficient mixer and a well-designed front end. If you are used to a loud "hissss" when you turn on your 70cm station, this will throw you for a loop at first! Don't let it fool you: The 475A has an excellent receiver. See for yourself with the bench tests shown in the sidebar.

Conclusions

All in all, the IC-475A lives up to the promise of its 2m cousin and offers excellent performance across the 70cm band. Hook it up to a good solid-state amplifier or a more powerful grounded-grid setup and you'll have a 70cm station anyone would be proud of! As a bonus, the AG-35S is no slouch and its design allows for excellent intermod performance vs. overall gain. The two make a hot setup for 432 weak-signal work, whether it be EME, tropo, or satellite work. The cost will bite more than you might expect at $1400, but I don't think this will seriously deter 70cm operators.

The bulk of my testing of the IC-475A was in the weak signal modes, since I do very little FM operation on 70cm. I feel this test is sufficient because, in the past, it hasn't been difficult to find multimodes that work well on FM, but are compromised on weak-signal performance. ICOM put an end to that trend with the IC-275A and IC-475A radios. If you are inclined to take the plunge in a big way on 70cm with a do-it-all station, the IC-475A is an excellent choice.

Performance Data:

ICOM IC-475A 70cm Multimode Transceiver
and
ICOM AG-35S 70cm Preamplifier

Specification	Claimed	Measured
Receiver Sensitivity		
SSB/CW 10-dB S/N	.1 μV	.12 μV
FM 12-dB SINAD	.18 μV	.15 μV
20-dB Quieting	.25 μV	.3 μV
Minimum Discernable Signal (dBm)	n/a	−135 dBm
1-dB Compression (RF and 1st-mixer stage)	n/a	+4 dB output
Total Conversion gain (RF and 1st-mixer stage)	n/a	18.5 dB
Squelch Sensitivity (FM, SSB)	.14 μV .56 μV	.13 μV .4 μV
Selectivity (FM)	15.0 kHz/6 dB 30.0 kHz/60 dB	15.0 kHz/6 dB 25.0 kHz/60 dB
Selectivity (SSB, CW)	2.3 kHz/6 dB 4.0 kHz/60 dB	2.5 kHz/6 dB 4.0 kHz/60 dB
RF Power output (FM, CW)		
430–449.000 MHz	25 HI/2.5 LO	30 HI/2.5 LO
AG-35S Preamplifier gain		
430–450 MHz	15 dB	12 dB
AG-35S Preamplifier 1-dB Compression	n/a	+6-dB output

All measurements made with Bird 43 Wattmeter, 10- and 50-D slugs, HP-608F signal generator, precision attenuators, and Boonton 92 RF millivoltmeter.

The receiver specifications are on a par with the IC-275A, which had a very good compression point. ICOM is finally getting the right stuff from their GaAsFET designs!

The IC-475A uses a quadruple-conversion scheme for SSB or CW work, with the first IF at 70 MHz, second at 9.0 MHz, third at 455 kHz and a fourth also at 9.0 MHz. FM uses a triple conversion set-up. The 1-dB compression point is not quite has high as I measured on the IC-275A, but is still excellent and as good as any standard transverter or receive converter.

73 Review

by Jerry Mangas N8EFG

The Heil BM-10 Boomset

A bit of magic from Sound Wizard Heil

Heil Ltd.
Heil Drive
Marissa IL 62257
Price class: $75

I went to the 1987 Dayton Hamvention, as many of us do, with an eye on both new equipment and bargain second-hand gear. A boom mike was on my list, and knowing that Heil would be there, I was determined to fight the crowd and check their product. Conditions were so crowded and chaotic on Friday, I waited until Saturday to get to the Heil exhibit. There were ongoing demonstrations there of both the Heil boomset mikes and the Heil speaker.

The boom mike demonstration set-up allowed you to listen to your own audio over another Heil product. I could check the audio output of both the HC-4 and the HC-5 microphone elements mounted in the boom mikes, and I liked the sound of both. The salesman assured me that the HC-5 would drive the ICOM rigs as stand-alone units (normally pre-amplified microphones are needed in the ICOM set-up). I asked that question repeatedly, in different ways, to be sure that we both understood each other and they repeatedly reassured me there wouldn't be any problems.

The boom mike with headset or "boomset" as Heil calls it, is a flyweight unit, with blue-foam-covered 32Ω earpieces, an adjustable headband, and a microphone that is both adjustable in extension and rotation. The fidelity of the earphones is not extreme, but more than sufficient for the limited 3-kHz bandpass of most of our modern rigs. The audio line and the earphone line are separate units. The lines are at least 100" long each, which seems absurd, until you forget that you are wearing the unit (it is that light) and lean back from your operating position, or try to turn around to the computer. You can get a long way away before the boomset is rudely jerked off your cranium.

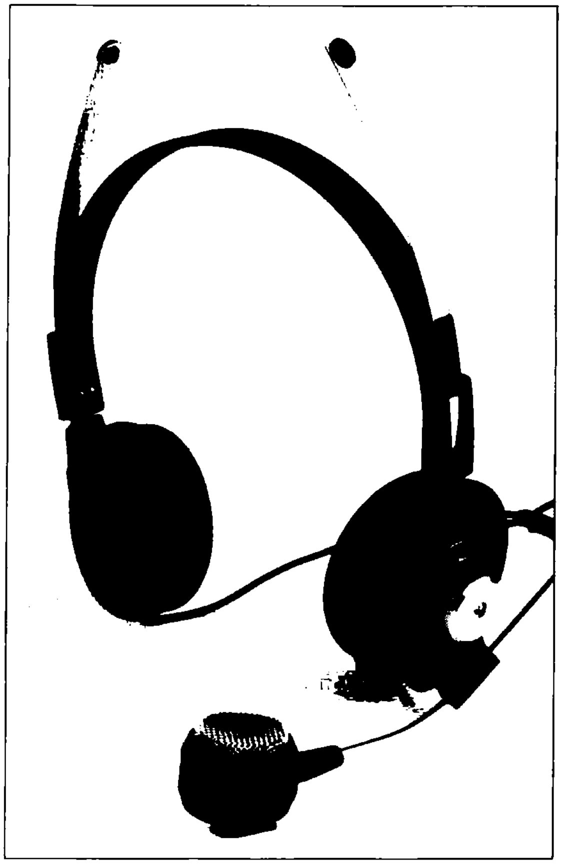


Photo A. The Heil BM-10 boomset.

The earphone line terminates with a standard stereo ¼-inch plug, and the microphone terminates with either a standard ¼-inch phone plug or, for 10 dollars more, an 8-pin plug to fit your newer rig. There may have been other types, but I didn't see them. I purchased the HC-5 (full-range) element with the standard ¼" plug set-up and later purchased an 8-pin plug to adapt to my ICOM 730. A friend, N8BNE, bought the HC-4 set to drive his Kenwood 430 and, coincidentally, my next-door neighbor, K8MDU, purchased an HC-5 set for his ICOM 735.

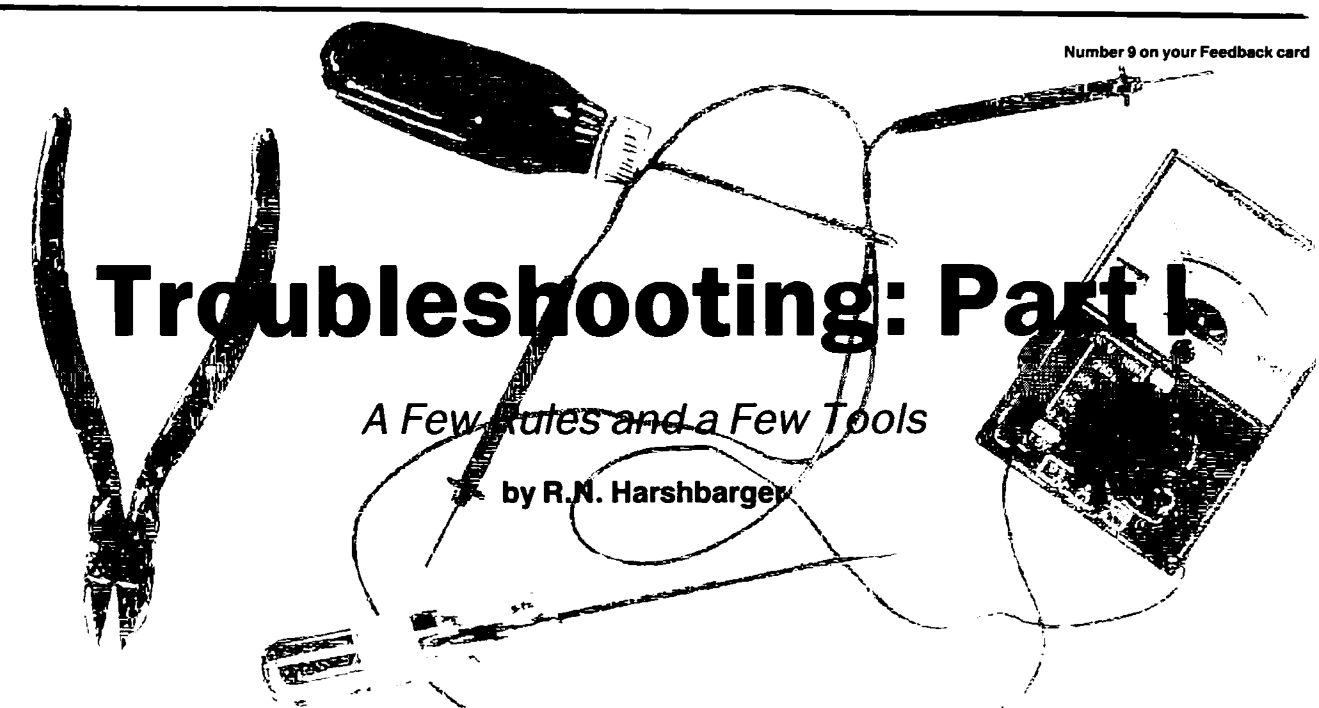
The proof of any purchase is in the operation, and these sets were put into use almost as soon as we groaned out of Dayton in our respective cars. The first change I had to make was to install a small blocking capacitor (.01µF) in the audio hot lead (the ICOM audio lead carries a DC voltage to power their pre-amp. The sets supplied with the eight-pin plug for the ICOM rigs include this capacitor).

The next thing that I discovered was that the HC-5 drives the ICOM with difficulty. I had to turn the microphone gain up to the full-output position to get any output from the rig. I tried various capacitors, but all they did was change the audio passband. A check on the air with N8BNE showed that his HC-4 into the Kenwood 430 operated just as promised, with the expected "Heil" quality audio (peaked at the 2200-Hz level). The audio reports I received on my HC-5 were mainly "nice audio, but very low level". Audio was good, or described as punchy, but "low." In other words, it does not really drive the ICOM 730, or the 735 directly, or at least not in the normal manner, with the mike gain ⅛ to ¼ open, nor with the gain wide open. K8MDU reported even less drive on his 735. Using my set on his rig showed the same effect, and vice versa.

The answer for me was to hook my HC-5 up to a small pre-amp, cobbled together from an "International Radio" schematic, which took care of all the drive problems and results in high output with excellent audio reports from the DX stations. When given a choice of a studio-grade microphone (a Shure 585SA or an ElectroVoice 634A) or the HC-5, most stateside stations preferred the studio grade, and the foreign stations without fail like the Heil over anything else that I tried. The state-siders that preferred the Heil over the more "bassy" studio mikes were for the most part DXers and liked their audio "punchy."

If you are looking for a very comfortable headset/microphone set-up; one that allows you to be aware of the rest of the household while you fight the pile-up using VOX operation; or if you want to work hands-free mobile using a VOX arrangement, and like the punchy effect of the various Heil elements, this is the set-up for you. Be sure, however, that you have a rig that doesn't demand a pre-amplified microphone. A push-to-talk switch could be easily wired into any of the 8-pin or 4-pin plugs if desired, or if VOX were not available on a particular rig. If you run ICOM gear, an external pre-amp or one of the various "equalizers" to properly drive your equipment may be required. ■

Jerry Mangas N8EFG lives at 5888 Rickfield North, Jackson MI 49201.



Troubleshooting: Part I

A Few Rules and a Few Tools

by R.N. Harshbarger

So that $1500 rig just went out to lunch or maybe that $2000 personal computer won't even acknowledge the power switch. If you've saved the original shipping carton, you're all set. You'll need to know the address of the "local" service center, maybe get a copy of the sales slip, and, oh yes, write for an RMA (Returned Material Authorization). Allowing for two-weeks transit time each way, and two weeks to get the RMA, you'll have eight weeks to study up for the Extra-class exam. On the other hand, you are a licensed ham, you know how to read a schematic, you understand the basic principles of electronics (hint: Ohm's Law), and eight weeks without a rig might cost you your marriage. Armed with a few rules and a few tools, you can very likely repair the rig and study for the Extra exam at the same time.

A FEW RULES

Safety First:

This well-worn slogan has to be the number-one rule here. A sincere respect for the hazards present in any piece of electronic equipment is the best safeguard available for a troubleshooter. The safety devices built into a piece of equipment can't be relied upon by the troubleshooter since he must remove guards and by-pass interlocks if the circuit is to be probed while energized. Follow this oft-used piece of advice when probing a live circuit: Keep one hand in your pocket and both eyes on the other hand. A clean, uncluttered work area with plenty of light and a pair of safety glasses are essential to safe troubleshooting.

Know the Circuit:

While the troubleshooter doesn't need the same level of understanding that the designer had, he must know what voltages to expect, and be able to follow the logical signal path. The more information the troubleshooter has at his disposal, the better. A good schematic diagram is a must. If your copy doesn't have such details as pin numbers, voltage levels, and a clearly marked signal path, then take a few hours to research these details and fill in the gaps. If you don't have a copy, then a note or phone call to the manufacturer is in order. The official service manual for your rig will probably cost less than the freight to send it in for repair.

Know the Problem:

Someone once wrote that if a problem is correctly stated, the answer is self-evident. Start with a paper and pencil, and list everything you know about the problem. List everything that works, and everything that doesn't. Be specific. List the positions of all the switches both when the problem exists and when it doesn't. Trust nothing to memory. State the problem in your own words and write everything down without regard to grammar or spelling. The organizational processes that your brain uses when you write will sometimes give you a whole new insight into the problem. All this pre-probe paperwork may initially seem unnecessary, but, by using this system, many a defective component has been singled out before the cabinet was removed.

Divide and Conquer:

A multi-page fold-out schematic is a little like a large metropolitan road map. When you first examine it, you may be overwhelmed, but on closer examination, it reveals many smaller neighborhoods, each with its own identity, and each making its own contribution to the large metropolis.

On an electronic schematic, you'll find neighborhoods with names like Power Supply, Oscillator, RF Amplifier, and Digital Readout. Looking at this transmitter as a whole may be daunting, but taken individually, they are much easier to understand, and much easier to troubleshoot. Here is where the list becomes important.

Use the list of things that work to eliminate the neighborhoods that work. Apply a little logic to eliminate some questionable neighborhoods. For example, if the digital readout works and it uses the +5-volt and +12-volt power supplies, then it's a safe bet that the +5-volt and the +12-volt power supplies work properly. After the defective neighborhood has been isolated, use the same technique to isolate the area of the neighborhood that's in trouble; and again isolate the specific active device not working; and again find the support element, such as a resistor, that is the problem. Each successive application of the divide-and-conquer system eliminates at least half of the remaining circuit until there is only one component remaining.

A FEW TOOLS

It would be easy to spend more money on the workbench than on the rig. Yet, in practice, there is only a handful of tools and equipment that you really need to troubleshoot and repair just about any piece of electronic equipment. A 14-hp garden tractor is nice if you're going to run a truck farm, but you can raise a very nice garden with a hoe, a rake, and a spade. When a piece of high-powered test equipment is absolutely necessary, it can be rented for a small fraction of the purchase price. In many towns, the high school shop is well-equipped and available, since the instructors are often hams.

A Good Meter:

One capable of measuring AC volts, DC volts, ohms, and AC/DC current is essential. It can be an older VTVM (Vacuum-Tube Voltmeter) or the newer transistorized VOM (Volt Ohmmeter). The cost will vary between $50 and $300 for a new unit, but a good used VTVM can be found at a local hamfest for as little as $25. Figure 1 is a list of the minimum requirements for the test bench meter.

Soldering Tools:

A good 25–40W soldering iron, a tip-cleaning sponge, and a stand will prove useful since few if any of the components are in sockets in the new rigs. You will also need a supply of rosin-core solder and some desoldering braid. A handful of alligator clips and a commercial typewriter eraser with a brush on one end are good soldering aids.

If you are a little rusty on your soldering technique, read up on the subject in the construction-practice section of one of the radio handbooks. To do it right, consider buying one of the self-teaching soldering courses available for less than $20.

Hand Tools:

These are another necessity, but you need not take out another second mortgage on the house if you shop around and stick to the essentials. Figure 2 lists the recommended hand tools. Don't skimp too much on the quality, because good hand tools will last a lifetime.

Miscellaneous Items:

Test clips in several colors, a tube of instant glue, a small magnet on a string, and a few baby food jars for hardware will come in handy.

THAT'S IT!

A few rules and a few tools. You are all set to take on just about any piece of ailing gear in the shack. What about things like oscilloscopes, signal generators, signal tracers, and digital frequency counters? These are valuable pieces of test gear, essential to the fully-equipped professional repair shop, where time is money, and the competition demands that the repair costs be kept down. When you determine that a high-priced piece of test equipment is needed, you can contact the local high school or the local technical school electronics instructor. If he doesn't have the equipment, he can probably introduce you to someone who does. Keep in mind, however, that most problems can be fixed without the expensive gear. ■

Originally from Pennsylvania, the author is an engineer for 3M in Minnesota. An avid runner and computer enthusiast, he lives at 3865 Granada Lane, Oakdale MN 55109, with his wife and three children.

Minimum Test Bench Meter Specifications

DC Volts	Lowest range should resolve 10 millivolts, highest range should measure 2000 volts.
AC Volts	Lowest range should resolve 10 millivolts, highest range should measure 2000 volts.
Resistance	Lowest range should resolve .1 Ohm. Highest range should measure 20 megohms.
Current AC/DC	Lowest range should resolve .1 milliamp, highest range should measure 2 amps.
Input Impedance	10 Megohms
Accuracy	±3% of reading.
Power Source	Internal battery or isolated AC line.

Table 1.

Minimum Tool Box Requirements

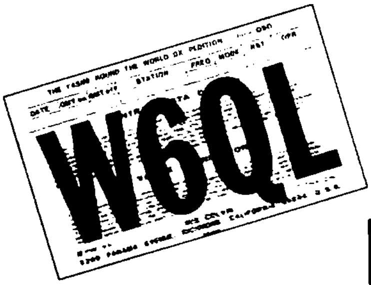
Essential	Cost
5¼" Long nose pliers	$4 to $6
4½" Diagonal cutters	$4 to $6
Wire Stripper (#12 to #24 wire)	$3 to $5
¼" Nut driver	$2 to $3
#1 Phillips screwdriver (3")	Less than $2
#3 Phillips screwdriver (6")	Less than $2
⅛" Blade screwdriver (4")	Less than $2
¼" Blade screwdriver (8")	Less than $2
Allen hex key set	$8 to $10

Essential	Cost
Plastic alignment tool set	Less than $3
Razor knife	Less than $2
Optional	
Vacuum desoldering tool	$5 to $8
Nut driver set (8 pcs)	$8 to $12
Electrician's knife	$2 to $5
Mirror on an 8" handle	$4 to $6

Table 2.

Number 10 on your Feedback card

73 SPECIAL PROFILE



LLOYD AND IRIS COLVIN —DXERS' DXERS

by Leon Fletcher N6HYK

superlative: the highest or utmost degree; the acme; surpassing all others.

In the world of hamming, superlative is certainly the word for the Colvins—Lloyd W6KG and Iris W6QL of Richmond, California. Together they have accrued more than a century of hamming. Lloyd was licensed in 1929 (59 years ago) and Iris was licensed in 1945 (43 years ago). Those 102 years of amateur radio operating have produced records—*many records*. Some will stand forever. Now, we can all improve our on-the-air skills with the essential tips this unique couple has shared with us.

The Colvins have devoted their lives to travelling the world on DXpeditions. They have operated from nations so exotic that they are not even mentioned in many geography books. They have been honored worldwide—by ham organizations, of course, and by foreign governments as well.

Drawing from their extensive hamming experience, the Colvins point to a few basic but essential tips—tips that every amateur radio operator should know to improve on-the-air skills. But to fully appreciate their suggestions, it is helpful to begin by knowing a bit about this distinctive couple.

Photo a. The Colvins—Iris (W6QL) and Lloyd (W6KG)—in their home shack in Richmond, California. (Photo by Leon Fletcher, N6HYK.)

Colvin Real Estate

"It all started in the wilderness of Alaska," Lloyd enjoys saying. There, shortly before World War II, he bought 40 acres of land a short distance outside of Anchorage. "I paid $1,000 for the property, and I had to borrow most of that."

It was land on which Lloyd planned to build a giant rhombic antenna. He started construction, but had erected only one tower when some officials in the Army Signal Corps decided that Lloyd's spread was the very place the military needed for its own radio station. "So I sold them the property for $40,000—a profit of 40 times in about a year. And no income tax!"

That experience launched Lloyd on a career of buying and selling property. To do that, it was obviously necessary to know exactly where particular plots of land were situated—to have properties surveyed. "But in those days there were very few surveyors in Alaska," Lloyd says. "Earlier, while studying for my degree in electrical engineering at the University of California at Berkeley, I had taken one course in surveying. That was enough for me to get a surveyor's license in Alaska."

Soon he branched out, got a contractor's license, and was building homes, offices, and industrial structures in Alaska and, later, in California. Along the way, his wife Iris also obtained a contractor's license and worked closely with Lloyd as the projects increased in number, size, and complexity.

Together they continued to build their resources—until 1965: "That year we sold our house, closed out the construction contracts we had going, and went on our first DXpedition."

Since then, Lloyd and Iris have:
Visited 181 countries.
Operated their ham stations in 110 countries.
Earned DXCC Awards in more than 90 countries.
Held more than 140 different calls.
Earned more than 60 awards.
Earned more than 400 certificates.
Worked, they believe, most of the active hams in the world.

Lloyd is named in the very top group of hams on the ARRL's DXCC Honor Roll—with confirmation from all of the 316 countries currently on the DXCC list. He's also worked an additional 37 countries that have been deleted from the list because of political or other changes. Thus, he has a total of 353 countries confirmed, as verified by the ARRL's most recent (June, 1987) report. Iris has confirmations from just one less country on the DXCC list—315. And she has worked an additional 23 countries that used to be on the list, for a total of 339 countries confirmed.

But perhaps their most impressive—indeed, startling—achievement is their collection of more than 525,000 QSL cards. "We have the world's largest collection," Lloyd claims. The cards are filed alphabetically, clearly a major task in itself. Also impressive are the statistics those cards produce:

All the cards weigh close to two tons.
They fill nearly 400 file drawers.

Those drawers occupy some 40 feet of giant metal cabinets.

There are about 1,400 cards in each drawer.

The average drawer weighs ten pounds.

The project took the equivalent of more than four years of full-time effort, 8 hours a day to handle those cards—to open the envelopes, sort, log, and reply.

Yet not quite all their cards are in those files. Lloyd likes to show visitors the 3-inch thick, hard-bound book in which he and Iris have mounted selected cards. Then he says with a playboy's smile: "If I want to start a conversation with an XYL—at a DX conference or someplace—I just show her this book." In it is a collection of hundreds of picture-QSL cards displayed under carefully-labeled headings—airplanes and automobiles, babies and birds, cats and cartoons, and on and on through the entire alphabet.

Iris is quick to respond. She displays another thick book of cards. It contains samples of the great variety of their own QSLs which they've mailed from their DXpeditions around the world.

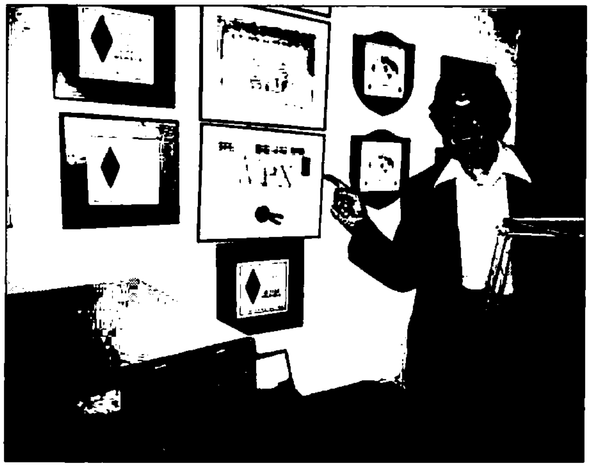


Photo B. Lloyd's WPX certificate, the very first such award issued to anyone, is dated December 1, 1957. The day before, feeling sure that the one more QSL card he needed for the award was sitting in the Alameda, CA, Post Office (which was closed for Sunday) he went to the office, and after repeated pleas, got an official to check the mail and find the final card. The next morning Lloyd flew East and hand-delivered his application just a few hours before a ham from K2-land arrived hoping to receive the first award. (The authorizing signature on Lloyd's award is by Wayne Green.) (Photo by Leon Fletcher, N6HYK.)

All those cards came from the more than *one million QSOs* the Colvins say they've made. That many contacts produce monstrous paperwork. For example, in 1984, when they returned from a 6-month DXpedition to 13 countries in South America, they faced 25,000 QSL cards to file. That was *after* weeks of work by three friendly hams who'd volunteered to open envelopes and sort, log, and reply to the cards.

The job of answering cards is made easier and quicker by use of special log sheets which the Colvins designed years ago. Those logs consist of two identical pages with a sheet of carbon paper between. As the Colvins operate, they write the information in the log just as it will appear on the QSL cards they'll send out—Date, GMT on, GMT off, Station, Freq, Mode, RST, Opr. The first–original–page of the logs is their permanent record; the second–carbon page–is cut into strips, each strip an individual contact. The backs of those strips are pre-covered with dry glue so it takes little time to wet them and attach them to the cards—another bonus from such logs: Hams who QSL the Colvins receive cards with the confirmations personally hand-written by these celebrated hams.

Packing Strategy

Computer-logging? Lloyd pauses. Iris answers: "We use a computer for the accounting in our business. But Lloyd doesn't really like computers. I don't think we'll ever use computers in our hamming."

If they did, that would add still more to the 400 pounds of gear they currently haul on their frequent overseas trips. "We spend hours trying to figure out how to reduce that load. We search for even a five-pound saving," Lloyd says. By now, however, after all their travels, their luggage is highly structured.

For their clothes, each takes just one suitcase—"not very big ones." They take a footlocker crammed full with the rotator for their beam, 20 pounds of coaxial cable, fittings, tools, and such. Their antenna (Hy-Gain TH-3) is specially cut so it and a mast fit into a custom-designed canvas bag eight inches in diameter, 6.5 feet long. "All that goes aboard our plane as luggage. We carry the rest of our station ourselves," Iris says. Lloyd adds, "If the airline loses our suitcases with our clothes, we can still operate—we can sit there in our underwear and operate. But we've got to have our gear to get on the air."

Lloyd lumbers aboard airplanes toting as carry-on luggage a 47-pound Tokyo Hi-Power HF band linear amplifier, Model HL-1K/A; a 27-pound ICOM 751 A transceiver; and a small airline-type, under-the-seat bag heavy with bits of gear for their station.

Lloyd smiles as he says, "Here at home I practice carrying that stuff—watching myself in a mirror—trying to look like I'm walking casually with just 20 pounds of luggage. And we *never* put our transceiver and amplifier in any kind of container. We always have it out in full view. That way airport security guards, airlines crews, even custom agents rarely bother us. They can see we're not trying to sneak aboard anything that's illegal."

Sometimes Iris takes over carrying one piece or another of the station, but not recently. Early in 1987, while on Maldive Island (8Q), she and Lloyd were coming down the rickety stairs of the government communications office—"the equivalent of our FCC," Lloyd says. "The bottom step was slanted downward at quite an angle. She slipped, I couldn't catch her, and she landed hard." Her leg was broken near her hip; she was flown to Sri Lanka (4S) for "the best medical service in the area."

Back at their home in October 1987, Iris said, "I'm really feeling pretty good now." But she was still walking with a cane. Occasionally her face showed her pain. Says Lloyd, "She'll always be carrying about a pound of metal in her leg."

Photo C. After every DXpedition, on the roof of the 3-story apartment building they built, Iris and Lloyd reassemble and check every unit of the Hi-Gain TH-3 beam they've used in countries around the world. (Photo by Leon Fletcher, N6HYK.)

Golden Hints

Based on their vast experience in DXing, the Colvins point to several specific techniques they feel hams should master:

First...the skill they consider the most important, by far: that same old, essential first step—the technique so very many hams still ignore: LISTEN! "Don't ask a DXer his or her call," pleads Lloyd, "They'll give it soon. We give ours every minute or so. Don't call on top of a QSO. Listen. Don't ask for frequencies—listen. Just listen!"

Lloyd likes calling stations to tail-end—to transmit their call just as the previous station is concluding the contact. "But tail-ending should be done *only* at the very end of a contact—*after* all essential information has been passed. And

never call in the middle of a QSO. You need to develop a feeling forwhen's the right moment to tail-end."

That point leads Iris to emphasize the importance of "working at the rhythm of the DX station." By that she means, if the DX station comes back fast, you should respond fast. But if the DX station repeats calls slowly, precisely, you should give your call slowly, precisely—the DX station probably is having trouble copying. If the DX station picks out stations by repeating just two letters, you should call with just two letters and not your entire call. If the DX station is asking operators for their names, you should give your name without being asked.

Another recommendation is implied in Lloyd's observation that "it seems like half of all hams don't know how to work split. Yet that's one of the most valuable tools for DXers."

Lists and nets? "They are important in some situations," Lloyd said. "I'm not against them. We prefer to work on our own, but if conditions make lists or nets necessary, we do them."

Iris and Lloyd both work considerable CW as well as phone. Lloyd says, "I generally work CW at about 25 words-per-minute. I can do a little over 40, but at that speed I have to repeat too much for many hams." He adds, "When calling stations are orderly and the pile-up is not too big, I can do 200 QSOs an hour." That's an average of one every 18 seconds.

The Colvins travel under the sponsorship of a tax-free YASME Foundation. YASME means "Good luck" in Japanese, and was the name of a boat sailing around the world in 1954 by a young Britisher, Danny Weil. On a stopover in the US Virgin Islands, he earned a ham license, then set sail on the world's first extended, continuous, week-after-week DXpedition. The foundation was established in 1961 to help Danny with expenses. In 1964 Danny married and decided to quit DXpeditioning. The next year, the Colvins started DXing under the aegis of YASME, but with the stipulation that they pay all of their own expenses.

Where To Now?

Where will they go on future DXpeditions? "We've been corresponding with government officials in a number of countries for some time, trying to get permission to operate, especially in those places in the top twenty of the most wanted-countries," Lloyd says. "We'll go to the first one that sends us authorization."

The day after this writer interviewed the Colvins, they were to leave on still another DXpedition—to Mexico, to work during upcoming contests. This time, rather than flying, they were to drive. Lloyd pointed to the truck he was about to pack for the trip—an 18-year-old Volkswagen double-cabin veteran which had already traveled nearly 200,000 miles. It seemed like a very modest vehicle for a couple who can afford to travel virtually full time. But earlier, when talking about flying, Lloyd had said, "We never fly first class. We never squander our money—we use it all for DXing."

Clearly, Lloyd means it when he takes Iris's hand—as he does often—and says, "Hamming is *everything* in our lives." Iris nods in agreement.

Photo D. Behind the Colvins is the banner listing countries they have visited, a visual they display at most of the many ham meetings at which they speak.

Photo E. When the Colvins worked as D68KG, Comoros, a country on a group of islands in the Indian Ocean, their beam needed frequent adjustment. The beach on which it was set faced constant high winds.

(Photo courtesy of Iris and Lloyd Colvin.)

Photo F. At the railroad station in Windhoek, Namibia, South West Africa, getting ready to take the Colvins to their operating site, a taxi driver lashes to his car the specially-designed canvas bag which contains their dismantled beam and mast.

(Photo courtesy of Iris and Lloyd Colvin.)

***A few of the more than 140 calls held by the Colvins*:**

C21NI	- Nauru
CT2YA	- Azores
CT3AU	- Andorra
FK0KG	- New Caledonia
HR0QL	- Honduras
KG4KG	- Guantanamo Bay
TU2CA	- Ivory Coast
TY2KG	- Benin
VP2MAQ	- Monserrat
VP2EEQ	- Anguilla
W6KG/TI5	- Costa Rica
W6QL/6Y5	- Jamaica
YJ8KG	- Vanuatu
ZB2AX	- Gibraltar
ZF2CI	- Cayman Island
3D2KG	- Fiji
5T5KG	- Mauritania
5V1KG	- Togo
6W8CD	- Senegal
9G1KG	- Ghana
9L1KG	- Sierra Leone

Leon Fletcher N6HYK of 274 Webster Drive, Ben Lomond, CA 95005, is the author of several textbooks on public speaking and has written for various publications.

by John Hugentober N8FU

The Art of DX QSL

Maximize your QSL return.

[The following article is reprinted from the September, 1987, issue of the Mike and Key *with the permission of editor Paul Riedel WB8NFT]*

Hear an Unusual Prefix on the Air?

1. First Ground Rule—W.F.W.L. (Work First, Worry Later). Even if you suspect a call may be a bootlegger (also called pirate or "slim"), it may appear in *73*, *QST* or *CQ*, as a legitimate operation.

2. To find out the country of the station, consult the Table of Allocation of International Call Sign Series in the *Callbook*. Take for example the call LP2AA. This is found in the range LOA-LWZ, placing it in Argentina. 8J5ITU is found in Japan.

Want a QSL?

1. If you're not concerned with a speedy response, use the Bureau. The Bureau is the only way for some stations since they give no direct address. Unfortunately, some return times are rather slow—three months to two years for the Russians—but often it is the only way.

To use the Bureau, get some 6 x 9 Manila envelopes, and send 3 to 4 of them to the address in front of the *Callbook*. Address the envelopes to yourself and place your call in the upper left-hand corner in large letters (one inch or so high), place at least 22 cents on each envelope, and send to the address shown. They will send them back to you periodically and let you know when you have used the last envelope. This takes care of incoming procedures.

Your Outgoing QSLs

You may send your cards out by mail (air mail is best) to the DX Bureau listed in front of the *Callbook* for all DX including Canada and US possessions (no continental USA.). KH6 and KL7 are considered DX. Some countries do not have QSL bureaus.

If you are an ARRL member, you may package up your DX cards, arranged alphabetically by prefix, and send them to ARRL (Outgoing QSL Division). Include the membership address sticker that was on the wrapper of your *QST* and $1 per pound or fraction (1½ pounds costs $2). You should send this money by check or money order made out to "ARRL". They will then send your cards to the respective bureaus by first-class mail monthly. I use this system extensively with very good results. You may make these mailings once a month if you wish.

"Even if you suspect a call may be a bootlegger (also called pirate or slim), it may appear in 73, QST or CQ, as a legitimate operation."

To QSL direct, send the QSL to the station by air mail, including a self-addressed envelope, preferably 4½" x 6" "tall" envelope. A lot of DX cards are taller than US cards and it is a shame to have the QSL for you folded and spoiled just because you didn't provide a large enough envelope.

There are three ways to cover this postage back to you (Send it along with the tall envelope.):

A. Send a dollar. This is generally not a good idea. Dishonest postal employees abound who steal money from the mail. Also, recipients in many countries may have a hard time exchanging currency, and it may even be illegal for them to have other countries' money in their possession.

B. Send International Reply Coupons (IRCs), available at Post Offices for 80 cents each. One IRC suffices to send your QSL direct, but more than one is required for return air mail (see front of Callbook).

C. Send W2AZX a SASE (Self-Addressed Stamped Envelope) and request his stamp list. This is, in my opinion, the cheapest and best way. He provides stamps for DX countries for a fraction of the IRC costs. Just put the stamps on your envelope that's coming back to you. The sender doesn't have to worry about buying stamps, which should shorten the return time.

The only reason I use direct mailing is if he says this is the only way, or I need his card for DXCC.

Now, if he says QSL VIA manager Joe Ham W2XXX, you want to send a normal-sized SASE along with your card to W2XXX. Place on the back of your envelope going to W2XXX the call of the DX station and the date of the QSO. This allows W2XXX to sort his incoming mail easily and process your card quickly.

Two Important Rules For All DX QSLs

1. Use GMT (also known as UTC) on all your DX QSLs. Your contact almost *always* uses this system, and it would be hard, if not impossible, for him to find your QSO on his log if you use local time. It would be especially misleading if he worked you during a contest, where a great number of stations are worked over a many-hour period. In fact, keeping a clock in the shack set to GMT is a good idea. It cuts down the confusion in logging skeds or filling out QSLs.

GMT is Eastern Daylight Savings Time (EDST) plus 4 hours, or Eastern Standard Time (EST) plus 5 hours, using the 24-hour clock. Remember that the new day starts at 2000 EDST. 2001 EDST Friday is 0001 UTC Saturday.

2. Spell out the month, or use day/month system. To a DX station, 8/2/83 reads February 8th instead of August 2nd. August second is best written "2 Aug 83", "2.8.83" or "2.VIII.83". Roman numerals rule out any doubt.

I hope these tips will further your skill in the art of QSLing! ■

Hamming is a family affair for John N8FU, whose wife Carol is K8DHK. Son John, Jr. is KC8MZ, and daughter Melody is KA8LAB. Carol and John are very active in 10-10, and John is the 8-area manager for this organization. John is 48 years old and a postal clerk whose hobbies include (of course!) DXing and stamp collecting.

by Steve Wolf NO8M

Number 12 on your Feedback card

In Praise of DX and WAS Nets

These much-maligned nets are more useful than you think.

"Working DX is like fishing . . . you just never know what you're going to catch" —Sen. Barry Goldwater K7UGA

There's a lot of print lamenting the crowded conditions on our amateur radio bands. Contesters are criticized for making 40 meters sound like a food processor on puree. DXers are derided for using oodles of band space in pileups in just making the contact instead of *communicating*. And nets! They say it takes divine intervention to find a non-net frequency on 20 meters. All for what? A 23-second contact to exchange the minimum required information to qualify for whatever paper they are chasing.

Do net operators and DXers do anything for amateur radio? You bet! I hope to explain here why they are there and how they can be of value to amateur radio.

DX Net Basics

Net operation is simple in principle. The main feature is the net control operator, the ham who coordinates the contacts made on the net by "checking-in" hams one at a time. He or she coordinates contacts with stations listening on the net. The net controller serves as the master of ceremonies and arbiter, maintaining net discipline and setting the pace of operation. Net controllers ask for check-ins, list callsigns of DX stations available for others to work, then give net participants a chance to work DX stations under relatively controlled conditions.

Nets give the little gun a chance to work some truly rare DX. Modest power and simple antennas are normally enough to get on the list and, once there, work the DX on a clear channel. DX nets are a good way of checking propagation conditions, too. This is due to the large number of stations from all areas of the world that check in—or not, as the case may be—in a short period. Most important, however, nets teach operators discipline and listening skills. Lack of discipline and the inability to listen to and obey the net control is a sure way to guarantee that would-be DXers will not make those desired contacts.

Domestic Awards Nets

In a Worked-All-States (WAS) net, stations from around the country check in with the hope of making a contact with stations in states they have not yet worked. Some people shake their heads at the WAS nets. They are just too easy and not in spirit with the "challenge" of amateur radio. These people are missing the fun of these nets. It is not simply a matter of working and confirming all 50 states. It is a matter of doing it five, ten or fifteen times. It is a matter of qualifying for awards that require a great deal of strategy.

Nets have the appeal of a chess tournament. Various awards programs require operators to amass a certain number of contacts or credit points. Simple contacts with states may count less than contacts with mobile operators in the state, those in the state capital, and other variations. An operator determines what contact he or she would like to make, depending on the "pieces" available on the net and the personal needs to achieve a particular award. The needed stations may take a break, or propagation may fail. Then it is time to consider a secondary strategy. The whole process can become addicting. It is the croquet of amateur radio.

While non-net operation involves some of the same skills, a net assures there are other players in the game. Some of the other players are masters from whom to learn operating skills.

There are very few things that will teach operators propagation better than WAS nets. On a typical net, stations represent all areas of the country. A quick check of callsigns will illustrate to where the band is open. Listening for a bit will show how the band reacts to changes in propagation. Over a period of months operators learn when and to where the bands will open. There are few better qualified amateurs than those who participate on these nets. They are finely attuned to the band and its characteristics. They have been around and noted band trends. Many times they offer propagation predictions no agency could produce. They can also offer guidance to those seeking the rare and elusive contact.

In Case of Emergency

I am in charge of emergency communications for a city of 40,000 residents, a position I have held for more than ten years. I have often considered how I would establish communication links on the HF band. Whom would I call, and what are their chances of success?

I can tell you whom I wouldn't call. The first off the list is the repeater fanatic. There they sit, waxing their rubber ducks, oblivious to spectrum outside of that defined by the input and output of their favorite repeater. Nor would I call the rag-chewer. They may be great talking to someone else about the type of dung used to fertilize their gardens. But when it comes time to pass a serious message under pressure or poor band conditions, they would fall on their face.

No, I would look elsewhere. The first place I would go for traffic destined out of the country would be the local DX repeater. With their (perhaps ridiculous) array of equipment and antennas, DXers are probably overqualified to handle anything I can give them. For domestic traffic, I would look for the person working on the WAS nets. When propagation on one band dies, I need someone who can change bands quickly and know what frequencies to use. I do not need some fool searching forty meters for a clear frequency between the broadcast stations. I need someone who can go to a net and instantly identify a callsign with a location. Net operators who work DX, states, or counties together have these skills.

I need commitment. I need someone who can recognize a goal and stick with me. Times will get boring. I don't need someone who goes off the air if they don't handle a message for over an hour. An award hunting net operator has the tenacity to stick with his goals, even though the odds may be against him. And above all, such an operator has discipline coupled with skill, an unbeatable combination when the chips are down.

Hearing an award net transform into an emergency net is a remarkable event. Many in the net have worked together for many years and know how each operates and their capabilities. The transition is smooth and professional. I can find that knowledge, that commitment, and that equipment in competitive net operators. 73

Steve is a police officer in Olmsted OH in charge of emergency communications for the police department. He is involved in local-area and county emergency preparedness and writes for amateur radio publications. His address is: Steve Wolf NO8M, 27132 Butternut Ridge Road, N. Olmsted OH 44070-4417.

Computerized Frequency Readout

by William Bawn, Jr. WA9RDE

Digital dial accuracy for the Yaesu FRG-7.

For years I had wanted to add a digital frequency display to my Yaesu FRG-7 general coverage receiver to improve the accuracy of my shortwave loggings. My experience with this receiver has shown that the calibration of the mechanical dial is not accurate across its full range.

While reviewing titles on the shelf in the computer section of a local bookstore I happened upon Easy Interfacing Projects for the Commodore 64. This book includes a project for a frequency counter which is the basis of my digital frequency display.

PARTS LIST C-64 DIGITAL FREQUENCY DISPLAY INTERFACE

C1	0.01 uF ceramic	(272-131)	2/.49
C2, C3	0.1 uF ceramic	(272-135)	2/.49
C4	10 uF - 16 V tantalum	(272-1436)	.69
R1,R7	1000 Ohm	(All resistors ¼ watt, 5%)	.07 each
R2	1M Ohm		
R3	4700 Ohm		
R4	240 Ohm		
R5,R8	390 Ohm		
R6	6800 Ohm		
Q1	MPF 102	(276-2062)	.79 each
Q2,Q3	2N4401	(276-2058)	.49 each
D1,D2	IN918/4148	(276-1122)	10/.99
IC1,IC2	7490	(276-1808)	1.19 each
	12/24 connector (connect to C-64 users port)	TRWR -405	2.58
Misc.	•2/c cable W/shield-to connect interface to 12/24 connector •Metal enclosure for interface circuitry •(Universal) printed circuit board		

Part numbers in parentheses refer to Radio Shack catalog numbers.

Inside the Receiver

The FRG-7 receiver uses a main dial tuning VFO which varies from 3455 KHz to 2455 KHz to tune across the selected megahertz band. The VFO is at 3455 on the low end of the dial and at 2455 on the high end. It tunes backwards. This technique, as well as several others, is common in modern receivers. Articles by Thomas M. Miller WA8YKN in the July '85 and May '85 issues of *73 Amateur Radio* aptly describe these designs. By monitoring the VFO frequency and subtracting from 3455 KHz, the received frequency can be calculated. Whereas dedicated hardware can be applied to this number crunching and display task, I let my C-64 handle this chore. The computer needn't be dedicated to the frequency display, either. An additional line or two of Basic will allow you to easily enter and exit this program so that the computer may also be used for other things.

An interface circuit is required to connect the receiver to the computer. The electronic components and the 12/24 connector shouldn't cost more than ten bucks. Adding a small mini-box, circuit board, and other miscellaneous items should still keep the total cost of this project around twenty dollars.

The interface schematic appears in Figure 1. The front of the interface (Q1, Q2, Q3) is from a frequency counter project appearing in the 1986 edition of the ARRL Handbook. This circuit couples to the receiver's VFO buffer amp. In the FRG-7 this point is a conveniently labeled test point TP404 on the IF-AF circuitboard. The two 7490 ICs are wired to divide the VFO frequency by 100. They provide waveshaping as well as TTL compatability to the C-64. In addition, they are required to prescale the count so as not to exceed the 65,535 event limit of the input register of the computer.

Circuit layout is not critical. I used a small universal printed circuitboard which was mounted in an aluminum box and installed inside of the receiver itself. The connection to the VFO is made using a short piece of shielded cable. The cable to the computer is a two-conductor (+5 volts and CNT2) with shield (GND).

The Program

The following line-by-line description of the program should provide you with enough information to explain its operation, allowing you to customize the program to your specific needs. I generally avoid using REMark statements within my programs. Instead I use separate, more lengthy explanations filed away with my hardcopy listing. I have been generous with line numbers to allow you plenty of room to modify the program for your own purposes.

Lines 10-110: Screen Display

The DATA statements are the Commodore ASCII character codes which are POKED to the screen in lines 80, 90, and 100, and form the outline of the frequency display dial. Line 70 clears and blanks the screen while the display is constructed. Line 110 turns the screen ON again.

Lines 120-320: Counter Routine

The counter routine is a machine language program taken from Easy Interfacing Projects for the Commodore 64. Lines 120-240 contain the machine language program itself and lines 250-280 read the program into memory beginning at address 49152. Line 290 sets the timebase to one second, POKEs this value into memory (line 300), and starts the counter with the SYStem command in line 310. The counter is read in line 320.

Lines 330-350: Calculating Frequency

Line 330 calculates the receiver's frequen-

cy. The actual number of counts is 65535-Count. This number is then subtracted from the low end of the dial (VFO frequency of 3455 KHz) to calculate the frequency display value. Lines 340 and 350 adjust the number for cases where the main dial is above or below the elected megahertz band.

Lines 360-470: Frequency Display Format

Line 360 converts the frequency number into a STRing which allows easy formatting of the display frequency on the screen. F$=MID$(F$,2) deletes the leading space which Basic automatically inserts for the sign of the number (+ or -).

Line 370 adds leading spaces to the string and then limits the string length to five spaces from the right.

Lines 380 to 420 assign variables to each of the five characters of the string. Lines 430 and 440 POKE the frequency to the screen. Note that the decimal point and trailing zero are fixed by this statement.

Line 450 is required to slow down the program while the counter is updated. Line 460 allows you to exit the program and return to Basic by hitting the RETURN key which sends the program to line 480 to clear the screen and execute a computer warm start. Line 470 loops the program to update the display if the RETURN key has not been pressed.

Program Modifications

The timebase for the counter makes use of the C-64's internal clock interrupt which occurs every 1/60th of a second. Commodore calls these intervals jiffies. The timebase of the frequency counter may be programmed in multiples of jiffies. This is done in line 290 where I have selected 60 jiffies, which equal one second. If you change the timebase be sure to modify the frequency calculation in line 330 accordingly. If, for example, you select a timebase of 6 jiffies (1/10 second), the frequency calculation needs to be muliplied by 10. One way to accomplish this would be to add a line 335 F=Fx10.

The program printed here is only a portion of the one I actually use. By defining other conditions (keyboard commands) in the GET statement of line 460, you can jump to other programs such as a logbook, RTTY/CW, etc. I use this technique to redefine the frequency calculation when using a VLF converter with my receiver. My converter monitors the 10 to 500 KHz frequencies by tuning the 3510 to 4000 KHz portion of the receiver's dial. I use the SPACE bar to tell the program to subtract an additional 500 KHz from the VFD frequency when using the VLF converter, and to display a message at the bottom of the screen to remind me that this feature has been selected. (The programming techniques for this are beyond the scope of this article.)

If you want a digital display that tracks the movement of the receiver's dial as rapidly as you can crank it, this project will fall short of your expectations. If you're willing to wait a couple of seconds for the frequency display to stabilize each time you reposition your receiver's dial, then you will find this presentation satisfactory.

I've cross-checked the frequency to the listed frequency of known commercial and fixed service stations and I find that I'm within 200 Hz. In contrast the calibration of my receiver's dial is within 5 kHz in the center and can be off by 30 kHz at either end. This simple project has improved the accuracy of my SWL loggings immensely.

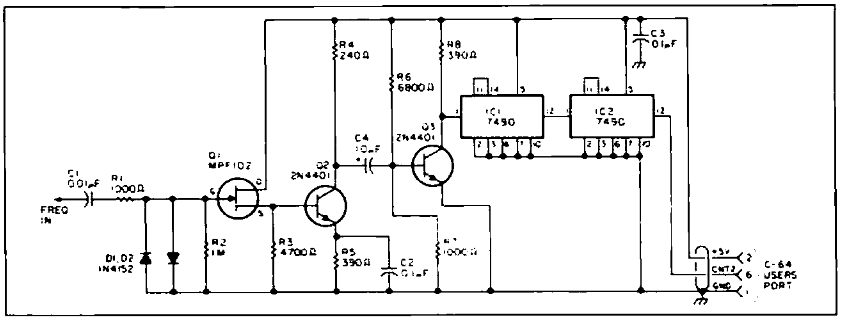


Figure 1.

William E. Bawn, Jr. WA9RDE lives at 10510 Inca Street in Northglenn, Colorado 80234.

```
10 REM COMMODORE 64 DIGITAL FREQUENCY DISPLAY
20 DATA236,226,226,226,226.226
30 DATA226,226,226,226,226,226,251
40 DATA97,32,32,32,32,32,32,32,32,11,8,26,225
50 DATA252,98,98,98,98,98,98,98,98
60 DATA98,98,98,254
70 PRINTCHR$(147):POKE53281,14
80 FORZ=0TO12:READX:POKE1197+Z,X:NEXTZ
90 FORZ=0TO12:READX:POKE1237+Z,X:NEXTZ
100 FORZ=0TO12:READX:POKE1277+Z,X:NEXTZ
110 POKE53281,1
120 DATA6,120,169,20,141
130 DATA20,3,169,192,141
140 DATA21,3,169,3,141
150 DATA13,221,40,88,96
160 DATA72,198,255,240,4
170 DATA104,76,49,234,165
180 DATA251,133,255,169,0
190 DATA141,14,221,173,5
200 DATA221,133,252,173,4
210 DATA221,133,253,169,255
220 DATA141,5,221,141,4
230 DATA221,169,33,141,14
240 DATA221,104,76,49,234
250 FORI=0TO64
260 READX
270 POKE(49152+1),X
280 NEXTI
290 BASE=60
300 POKE255,0:POKE251,BASE
310 SYS49152
320 COUNT=(PEEK(252)*256+PEEK(253))
330 F=(34550-(65535-COUNT))
340 IFF<0THENF=10000+F
350 IFF>10000THENF=F-10000
360 F$=STR$(F):F$=MID$(F$,2)
370 F$=RIGHT$("      "+F$,5)
380 A=ASC(MID$(F$,1))
390 B=ASC(MID$(F$,2))
400 C=ASC(MID$(F$,3))
410 D=ASC(MID$(F$,4))
420 E=ASC(MID$(F$,5))
430 POKE1238,A:POKE1239,B:POKE1240,C:POKE1241,D
440 POKE1242,46:POKE1243,E:POKE1244,48
450 FORW=1TO1000:NEXTW
460 GETA$:IFA$=CHR$(13)GOTO480
470 GOTO320
480 PRINTCHR$(147):SYS58235
```

Table 1.

On-the-Air DX Gatherings

125 Chances to increase your country count

The following is a list of DX nets that meet on a regular basis. One star, ★, indicates a popular Net, two stars, ★★, indicate an especially popular Net.

TIME(UTC)	NET	FREQUENCY	DAY
00:00	Bulletin	3.524 MHz	Daily
★00:00	DX Net	14.243 MHz	Daily
★01:00	Brasil DX Net	14.180 MHz	Mon.
01:00	Hawaiian Cocktail Net	14.305 MHz	Daily
01:00	IARS Net (USA)	14.297 MHz	Daily
★★01:00	Rare Russian DX Net	3.640 MHz	Wed.
02:00	CHC Net (USA)	14.297 MHz	Daily
★02:00	Gull Coast DX Net	3.787 MHz	Daily
★02:00	NCDXF DX Bulletin	14.002 MHz	Mon.
02:00	Pacific Net	14.313 MHz	Daily
02:30	Seafarers Net	14.313 MHz	Daily
★03:00	Arabian Knights Net	14.250 MHz	Thu-Fri.
★★03:00	Brown Sugar DX Net	14.309 MHz	Daily
03:00	Gulf DX Net	3.787MHz	Sat, Sun
03:00	UT4UI UF6-Land DX Net	7.019 MHz	N/A
★★04:00	International DX Ass.	14.263 MHz	Daily except Wed.
★04:00	Rare Russian DX Net	7.045 MHz	Fri-Sun.
04:30	ANZA Net	21.203 MHz	Daily
★05:00	220 Net Jim Smith P29JS	14.220 MHz	Daily
05:00	European Weather Net	3.680 MHz	Mon.-Fri.
★05:00	Pacific Net	14.314 MHz	Daily
05:00	Trans Pacific Net	14.052 MHz	Sat.
★★06:00	40 Mtr. DX Net	7.080 MHz	Daily
06:00	Young Lady Pacific Net	14.220 MHz	Mon.
★★06:00	Arabian Knights Net	14.250 MHz	Fri.
06:00	Intern. Pacific Net	14.265 MHz	Fri.
06:30	IARS Net (UK)	14.297 MHz	Daily
★06:30	DX Net	14.243 MHz	Sat.
06:30	Antilles Weather Net	3.815 MHz	Daily
★★07:00	220 Net	14.220 MHz	Tue.
07:00	Ship Service Net	14.313 MHz	Daily
★★07:00	ZL DX Net	7.085 MHz	Sun-Thur.
07:45	Medical Assistance Net	14.334 MHz	Daily
07:45	IARS Net (USA)	7.230 MHz	Sat.
08:00	Intern. Island Pacific Net	14.315 MHz	N/A
08:00	Intern. Pacific Net	14.250 MHz	Daily
★09:00	10 Mtr. DX Net	28.520 MHz	Daily
09:00	Amsat Austria Net	7.070 MHz	Sun.
09:00	Australia Net	14.302 MHz	Daily
09:00	Canary Net	7.035 MHz	Daily
09:00	New Zealand Net	3.650 MHz	Sun.
09:00	P-29 Net	14.257 MHz	Sun.
09:00	Pacific DX Net KX6PO	14.345 MHz	Sun.
09:00	South Africa Net	14.280 MHz	Sun.
09:00	Triple "H" Net	7.250 MHz	Daily
09:00	YL DX Net	14.333 MHz	Daily
09:30	Alaska Net	14.292 MHz	Daily
09:30	Austria Net	3.600 MHz	Sun.
10:00	Amsat Australia Net	3.680 MHz	Sun.
10:00	Amsat Europe Net	14.280 MHz	Sat.
★10:00	International DX Net	21.157 MHz	Daily
10:00	Isle of Man Net	7.090 MHz	Sun.
10:00	South Pacific Net	28.555 MHz	Sun.
11:00	Amsat Pacific Net	14.305 MHz	Sun.
11:00	DK9KE Net	21.155 MHz	Daily
★11:00	DX Net	14.195 MHz	Wed.
★★11:00	Friendly Caribbean Net	14.283 MHz	Daily
11:00	Intern. Assistance and Traffic	14.302 MHz	Daily
★12:00	African Service Net	21.317 MHz	Sun.
★12:00	DX Info Net RTTY	14.098 MHz	Daily
★12:00	East Asia Net	14.320 MHz	Daily
12:00	Intern. Young Lady Net	14.332 MHz	Daily
12:00	Sea Net (East Asia Net)	14.320 MHz	Daily

TIME (UTC)	NET	FREQUENCY	DAY
★12:00	Trans-Atlantic Net	21.400 MHz	Sun.
13:00	Central Indonesia Net	21.300 MHz	Daily
13:00	Waterway Net	7.268 MHz	Daily
13:45	Waterway Net	3.945 MHz	Daily
14:00	Rare DX Net, JY32H	14.223 MHz	Most Days
★14:00	W7PHO Net	14.227 MHz	Daily
14:00	SU1PL and EA6MR Info.	14.212 MHz	Sat.
15:00	W1AW Bulletin	14.068 MHz	Mon, Wed, Fri
★★15:00	Family Hour	14.225 MHz	Daily
15:00	Kate's Navy Net	14.295 MHz	Daily
15:00	Russian Island Net	14.150 MHz	Mon.
15:00	Snooky's Net	21.335 MHz	Daily
15:30	Serape Net	7.285 MHz	Sun.
★16:00	All-India Net	14.150 MHz	Daily
16:00	Coast Guard Net	14.313 MHz	Daily
16:00	Intern. Handicappers Net	14.287 MHz	N/A
★16:00	Sri Lanka Net	14.290 MHz	Mon.
16:30	Firac Net	3.680 MHz	Wed.
17:00	Alaska Pacific Net	14.292 MHz	N/A
17:00	Aphrodite Net	28.500 MHz	Mon.
★★17:00	Family Hour	14.225 MHz	Daily
17:00	Good News Net	14.250 MHz	Daily
17:00	Intercontinental Traffic Net	21.390 MHz	Daily
17:00	International Police Net	21.400 MHz	Sun.
★17:00	KH6 Net	14.340 MHz	Mon.
17:00	Norway Net	14.320 MHz	Mon.
17:00	Roundtable DX Net	14.175 MHz	N/A
17:30	DIG Net	3.677 MHz	Thur.
17:30	DX to DX Net J73LC	21.280 MHz	Daily
17:30	KH6 Net	14.340 MHz	Fri.
★17:45	Veron DX Net	3.602 MHz	Fri.
★★18:00	Africa Round Table Net	14.180 MHz	Thur.
18:00	Afrikaaner Net	21.355 MHz	Sept. to Easter
18:00	DARC Info Net	3.750 MHz	Fri.
18:00	DIG CW Net	3.555 MHz	Wed.
★18:00	DX Info Net	3.740 MHz	Mon.
★★18:00	French DX Info Net	14.170 MHz	Daily
18:00	Paradise Island Net	21.285 MHz	Daily
★★18:00	Smokies Net	14.183 MHz	Daily
18:30	African Safari Net	21.292 MHz	Daily
19:00	Children's Hour	2.738 MHz	Daily
19:00	Family Net	7.288 MHz	Daily
19:00	Manama Net	14.340 MHz	Daily
★19:00	Round Table DX Net	14.175 MHz	Daily
★19:00	Snooky KAIE	14.183 MHz	Daily
★19:30	DX Net	3.767 MHz	Mon.
★19:45	Veron DX News	3.062 MHz	Fri.
★20:00	YL DX Net	14.333 MHz	Daily
★20:00	160 Mtr. Net	1.849 MHz	Daily
20:00	Confusion Net	14.305 MHz	Daily
20:00	Pacific DX Net	21.292 MHz	Fri-Sat.
★20:00	W7PHO Evening Net	14.227 MHz	Daily
★21:00	Russian DX Net	3.640 MHz	Thur.
22:00	Amsat South Pacific Net	28.878 MHz	Sat.
★22:00	Far East Net	14.178 MHz	Fri-Sun.
22:00	Maritime Net	14.313 MHz	Daily
22:00	United Nations Net	14.250 MHz	Tue.
★23:00	Central America Net	21.400 MHz	Daily
★★23:00	Family Hour	14.225 MHz	Daily
23:00	Greenland Net	3.650 MHz	Wed, Sun.
★23:00	Japan Net	21.330 MHz	Sun.
★23:30	Intern. DX Net Evening	14.236 MHz	Daily except Wed.

ANNOUNCING: 73 Magazine's DX Dynasty Award

One day not too long ago the staff of *73* was sitting at lunch over at the Folkway talking about DX and DXing and how crazy DXCC had gotten. The DXCC Honor Rollers have nothing left to work, and folks coming into the program have no hope of working countries that haven't been on the air for twenty years.

By the time we got around to coffee and mocha chip cake we had decided to start our own DX award. We wanted everyone to start with zero countries to liven things up a bit on the bands. Wayne suggested that we add to the ARRL's DXCC countries list by searching through the awards programs of IARU members. We decided to offer endorsements for every mode we could think of.

We want you to have fun with this award. The rules are simple, but the variety of levels and endorsements make the award a challenge for both the beginner and the experienced DXer. We've come up with 400 countries, so you won't run out of countries too soon!

The Award

The basic award will be issued for 100 countries worked. Endorsements will be made for 150, 200, 250, 300, 350, 375, and 400 countries worked. The basic award is mixed-mode. Special endorsements are available for single-band operation and for specific modes, including CW, SSB, satellite, Baudot, RTTY, ASCII RTTY, AMTOR, packet, spread-spectrum, QRP (less than 5 Watts output), EME, FM, AM, FAX, SWL, and SSTV. Logs submitted for special endorsements must clearly indicate the band and mode used for all contacts.

THE RULES

Effective Date: Only contacts made after 0001Z on January 1, 1987, will be eligible for the DXD Award.

Bands: Contacts may be made on any amateur band.

Modes: Any mode available to amateurs in your country may be used. Cross-mode contacts are allowed: The mode that you use counts for the DXD Award.

Minimum Report: There is no minimum signal report (you can't work 'em if you can't hear 'em).

Applications: QSL cards are not required for the DXD Award. Application must be made on an official DXD form, available from *73* Magazine-send an SASE to WGE Center, Peterborough NH 03458, Attn: DXDA. On the form, list your contacts in callsign order, indicating date, time, frequency or band, mode, and power. We may, on occasion, ask to see your log—so no funny business.

Fees: The fee for the basic award, due upon application, is US $6. IRCs are not accepted. Each additional endorsement is US $2. *Note: Endorsements requested on your first application are free.*

Country Criteria: Countries on the DXD Award list are taken from the awards programs of IARU member nations. If you come across a country not on the list that you feel should be included, send a copy of award rules from an IARU member that lists that country as being valid for an award to *73* Magazine for evaluation. New countries will be added as needed and announced in *73*.

Countries List: The DXD Award countries list will be printed from time to time in *73*. A copy of the current list (just under 400 countries, but still climbing) and an official application form are available from *73* Magazine, WGE Center, Peterborough NH 03458, Attn: DXDA.

Ready, Set...

Who will be the first to hit the 300 country mark? Everyone has an equal shot at it, starting January 1st. We'll publish a list of DXD Award holders regularly so that you can see how you are doing.

Excuse me. I see that the bands just opened...CQ DX. CQ DX. CQ DX...

To receive a copy of the current DX Dynasty Award countries list and an official application form, send a SASE to 73 Magazine, WGE Center, Peterborough NH 03458, Attn: DXDA. 73's DX Map of the World is available for $5 ppd.

Official DX Dynasty Countries List: 1/1/88

ABU AIL	
AFGANISTAN	YA
AGALEGA ISLAND	3B6
AGALEGA	3B6
ALAND ISLAND	OHØ
ALASKA	KL7
ALBANIA	ZA
ALDABRA ISLAND	VO9
ALGERIA	7X
AMERICAN SAMOA	KS6
AMSTERDAM ISLAND	FT8
ANDAMAN ISLAND	VU4
ANDORRA	C3
ANGOLA	D2
ANGUILLA	VP2E
ANTARCTICA	KC4
ANTIGUA	V2
ANTIPODES ISLAND	ZL
ARAN ISLAND	EJØ
ARGENTINA	LU
ARMENIA	UG
ARUBA	PJ4
ASCENSION ISLAND	ZD8
AUCKLAND ISLAND	ZL4/A
AUSTRALIA	VK
AUSTRIA	OE
AVES ISLAND	YVØ
AZERBAIJAN	UD
AZORES ISLANDS	CT2
BAHAMA ISLANDS	C6
BAHRAIN	A9
BAKER ISLAND	KH1
BALEARIC ISLANDS	EA6
BANGLADESH	S2
BARBADOS	8P8
BEAR ISLAND	JW
BELGIUM	ON
BELIZE	V3
BENIN	TY
BERMUDA	VP9
BHUTAN	A5
BOLIVIA	CP
BONAIRE	PJ9
BONIN	JD1
BOPHUTHATSWANA	H5
BOTSWANA	A2
BOUNTY ISLAND	ZL
BOUVET ISLAND	3Y
BRAZIL	PP-PY
BRITISH VIRGIN ISLANDS	VP2V
BRUNEI	V8
BULGARIA	LZ
BURKINA FASO	XT
BURMA	XZ
BURUNDI	9U
BYELORUSSIA	UC
CAMEROON	TJ
CAMPBELL ISLAND	ZL4/A
CANADA	VE
CANARY ISLANDS	EA8
CAPE VERDE ISLANDS	D4
CAPRI ISLAND	IC
CAYMAN ISLANDS	ZF
CELEBES	YB
CENTRAL AFRICAN REPUBLIC	TL
CENTRAL KIRIBATI	T3
CEUTA AND MELILLA	EA9
CHAD	TT
CHAGOS	VO9
CHATHAM ISLAND	ZL
CHESTERFIELD ISLAND	FK8
CHILE	CE
CHINA	BY
CHRISTMAS ISLAND	VK9X
CLIPPERTON ISLAND	FOØ
COCOS ISLAND	TI9
COCOS/KEELING ISLAND	VK9Y
COLOMBIA	HK
COMINO IS	9H
COMOROS	D6
CONGO	TN
COOK ISLAND	ZK1
CORSICA	TK
COSTA RICA	TI
CRETE	SV9
CROZET ISLAND	FB8W
CUBA	CO
CUETA AND MELLILA	EA9
CURACAO	PJ
CYPRUS	5B4
CZECHOSLOVAKIA	OK
DENMARK	OZ
DESECHEO ISLAND	KP5
DESROCHES	VQ9
DIEGO GARCIA	VQ9
DJIBOUTI	J2
DODECANESE ISLANDS	SV5
DOMINICA	J7
DOMINICAN REPUBLIC	HI
EAST CAROLINE ISLANDS	KC6
EAST GERMANY	Y2
EAST KIRIBATI	T3
EASTER ISLAND	CEØ
ECUADOR	HC
EGYPT	SU
EL SALVADOR	YS
ENGLAND	G
EQUATORIAL GUINEA	3C
ESTONIA	UR
ETHIOPIA	ET
EUROPA ISLAND	FR/E
FALKLAND ISLANDS	VP8
FAROE ISLANDS	OY
FAROUHAR	VO9
FERNANDO DE NORONHA	PYØF
FIJI ISLANDS	3D2
FINLAND	OH
FRANCE	F
FRANZ-JOSEF LAND	UA1
FRENCH GUIANA	FY
FUTUNA ISLAND	FW
GABON	TR
GALAPAGOS ISLAND	HC8
GAMBIA	C5
GEORGIA	UF
GHANA	9G
GIBRALTAR	ZB2
GLORIOSO ISLAND	FR/G
GOUGH ISLAND	ZD9
GOZO ISLAND	9H4
GRAHAM LAND	VP8
GREECE	SV
GREENLAND	OX
GRENADA	J3
GUADELOUPE	FG
GUAM	KH2
GUANTANAMO BAY	KG4
GUATEMALA	TG
GUERNSEY	GU
GUINEA	3X
GUINEA-BISSAU	J5
GUYANA	8R1
HAITI	HH
HAWAII	KH6
HEARD ISLAND	VKØ
HONDURAS	HR
HONG KONG	VS6
HOWLAND ISLAND	KH1
HUNGARY	HA
ICELAND	TF
IFNI	EA9
INDIA	VU
INDONESIA	YB
IRAN	EP
IRAQ	YI
IRELAND	EI
ISCHIA	IC
ISLE OF MAN	GD
ISRAEL	4X
ITALY	I
IVORY COAST	TU
JABAL ATTAIR	
JAMAICA	6Y
JAN MAYEN ISLAND	JX
JAPAN	JA
JARVIS ISLAND	KH5
JAVA	YB
JERSEY	GJ
JOHNSTON ISLAND	KH3
JORDAN	JY
JUAN DE NOVA ISLAND	FR/J
JUAN FERNANDEZ ISLAND	CEØ
KALININGRAD	UA2
KAMARAN ISLAND	VS9
KAMPUCHEA	XU
KAZAKH	UL
KENYA	5Z
KERGUELEN ISLAND	FB8W
KERMADEC ISLAND	ZL1/K
KIRGHIZ	UM
KOREA	HL
KURE ISLAND	KH7
KUWAIT	9K
KWAJALEIN	KX6
LABRADOR	VO2
LACCADIVE ISLANDS	VU7
LAMPEDUSA ISLAND	IG
LAOS	XW
LATVIA	UO
LEBANON	OD
LESOTHO	7P
LESSER ANTILLES	PJ
LEVANZO ISLAND	IF9
LIBERIA	EL
LIBYA	5A
LIECHTENSTEIN	HBØ
LINE ISLANDS	T3L
LITHUANIA	UP
LORD HOWE ISLAND	VK2
LUXEMBOURG	LX
MACAO	XX
MACOUARIE ISLAND	VKØ
MADAGASCAR	5R
MADDALENA ISLAND	IM
MADEIRA ISLAND	CT3
MALAWI	7O
MALAYSIA	9M2
MALDIVE ISLANDS	8O
MALI	TZ
MALPELO	HKØ
MALTA	9H
MANIHIKI	ZK1
MARCUS ISLAND	JD
MARIANA ISLAND	KHØ
MARION ISLAND	ZS2
MARKET REEF	OJØ
MAROUESAS ISLAND	FO8
MARSHALL ISLAND	KX6
MARTIM VAS ISLAND	PYØ
MARTINIQUE	FM
MAURITANIA	5T
MAURITIUS ISLAND	
MAYOTTE	FH
MEXICO	XE
MIDWAY ISLAND	KH4
MINAMI TORI SHIMA	JD1
MIOUELON ISLAND	FP8
MOLDAVIA	UO
MONACO	3A
MONGOLIA	JT
MONSERRAT	VP2M
MOROCCO	CN
MOUNT ATHOS	SY
MOZAMBIQUE	C8
NAMIBIA	ZR3,ZS3
NAURU	C2
NAVASSA ISLAND	KP1
NEPAL	9N1
NETHERLANDS	PA
NETHERLANDS ANTILLES	PJ
NEVIS ISLAND	V47
NEW CALEDONIA	FK
NEW HEBRIDES	YJ
NEW ZEALAND	ZL
NEWFOUNDLAND	VO1
NICARAGUA	YN
NICOBAR ISLAND	VU4
NIGER	5U
NIGERIA	5N
NIUE ISLAND	ZK2
NORFOLK ISLAND	VK9N
NORTH KOREA	D9
NORTH YEMEN	4W
NORTHERN IRELAND	GI
NORWAY	LA
OGASAWARA ISLAND	JD1
OKINO TORI SHIMA	7J
OMAN	A4
PAKISTAN	AP
PALMYRA ISLAND	KH5
PANAMA	HP
PANTELLERIA ISLAND	IH
PAPUA NEW GUINEA	P2
PARAGUAY	ZP
PERU	OA
PETER 1ST ISLAND	3Y
PHILIPPINES	DU
PHOENIX	T3P
PITCAIRN ISLAND	VR6
POLAND	SP
PONZIANI ISLAND	IBØ
PORTUGAL	CT
PRINCE EDWARD ISLANDS	VE1
PRINCE EDWARD ISLAND	ZS2
PRINCIPE	S9
PRIVILOF	KL7
PROVIDENCIA ISLAND	HKØ
PUERTO RICO	KP4
OATAR	A7
RAPA ISLAND	FO8
REUNION ISLAND	FR/R
REVILLA GIGEDO ISLAND	XF4
RIO DE ORO	EA9
RODRIGUEZ ISLAND	3B9
ROMANIA	YO
RONACDOR CAY	HKØ
ROTA ISLAND	KH2
RUSSIA - SIBERIA	UA9-Ø
RUSSIAN S.F.S.R.	UA
RUSSIAN - URAL MT	UA9-Ø
RWANDA	9X
RYUKYU ISLAND	JR6
SABA ISLAND	PJ
SABAH	9M6
SABLE ISLAND	VE1
SAIPAN	KH2
SAKHALIN ISLAND	UA9-Ø
SAN ANDRES ISLAND	HKØ
SAN FELIX ISLAND	CEØX
SAN MARINO	T7
SAO TOME	S9
SARAWAK	9M8
SARDINIA	IS
SAUDI ARABIA	HZ
SCOTLAND	GM
SENEGAL	6W
SERRANA BANK	HKØ
SEYCHELLES	S79
SICILY	IT9
SIERRA LEONE	9L
SINGAPORE	9V
SINT EUSTATIUS	PJ
SINT MAARTEN ISLAND	PJ
SMOM	1A
SOCIETY ISLAND	FO8
SOCOTRA ISLAND	7O
SOLOMON ISLANDS	H44
SOMALI REPUBLIC	T5
SOUTH AFRICA	ZS
SOUTH GEORGIA ISLAND	VP8
SOUTH ORKNEY ISLAND	VP8
SOUTH SANDWICH ISLAND	VP8
SOUTH SHETLAND ISLAND	VP8
SOUTH YEMEN	7O
SPAIN	EA
SPRATLY ISLAND	1S
SRI LANKA	4S
ST BRANDON ISLAND	3B7
ST HELENA ISLAND	ZD7
ST KITTS	V44
ST LUCIA	J6
ST MARTIN ISLAND	FS
ST PAUL ISLAND	FT8
ST PETER AND PAUL ROCKS	PYØ
ST PIERRE ISLAND	FP8
ST VINCENT	J8
SUDAN	ST
SUMATRA	YB
SURINAM	PZ
SVALBARD ISLAND	JW
SWAN ISLAND	HRØ
SWAZILAND	3D6
SWEDEN	SM
SWITZERLAND	HB
SYRIA	YK
TADZHIK	UJ
TAIWAN	BV
TANZANIA	5H3
TASMANIA	VK7
THAILAND	HS
TINIAN	KHØ
TOGO	5V
TOKELAU	ZM7
TONGA ISLAND	A3
TRANSKEI	S8
TRANSVAAL	T4
TRINIDADE ISLAND	PYØ
TRINIDAD AND TOBAGO	9Y
TRISTAN DA CUNHA	ZD9
TROMELIN ISLAND	FR/T
TUAMOTU ARCHIPELAGO	FO8
TUBUAI	FO8
TUNISIA	3V
TURKEY	TA
TURKMEN	UH
TURKS AND CAICOS ISLANDS	VP5
TUSCAN ARCHIPELAGO	IA
TUTUILA ISLAND	KH8
TUVALU	T2
UGANDA	5X
UKRAINE	UB,UT,UY
UNITED ARAB EMIRATES	A6
UNITED NATIONS - NEW YORK	4U1UN
UNITED NATIONS - GENEVA	4U1ITU
UNITED NATIONS - VIENNA	4U1VIC
UNITED STATES	W,K,N,A
URUGUAY	CX
USTICA ISLAND	IE9
UZBEK	UI
VANUATU	YJ
VATICAN CITY	HV
VENEZUELA	YV
VIETNAM	XV
VIRGIN ISLANDS	KP2
WAKE ISLAND	KH9
WALES	GW
WALLIS ISLAND	FW
WAYNE GREEN	W2NSD
WEST CAROLINE ISLAND	KC6
WEST GERMANY	DL
WEST KIRIBATI	T3
WESTERN SAMOA	5W1
WESTERN SAHARA	SØ
WILLIS ISLAND	VK9Z
WORLD BANK	4U2
YEMEN	4W
YUGOSLAVIA	YU
YUKON	VY1
ZAIRE	9O
ZAMBIA	9J
ZANZIBAR	5H1
ZIMBABWE	Z21

DYNASTY 100: The New DX Generation

The first 100 to work 100

1	W1RFW	100 Mixed
2	WB2DIN	100 150 200 250 Mixed
3	KT1A	100 Mixed
4	W3FDU	100 All 20M SSB
5	KA9JOL	100 All SSB
6	WB1BVQ	100 150 All SSB
7	NW7O	100 All SSB
8	AK4H	100 All SSB
9	W3HCW	100 All SSB
10	KZ2W	100 All SSB
11	K9FD	100 150 200 Mixed
12	WD5N	100 Mixed
13	KA9TNZ	100 All SSB
14	K9GBN	100 All SSB
15	N5GAP	100 All SSB
16	WB3FMA	100 All SSB
17	NN6E	100 20M CW
18	AL7HG	100 All SSB
19	N6CGB	100 150 All SSB
20	KI6AN	100 Mixed
21	K9JPI	100 Mixed
22	N4WF	100 150 All SSB
23	K6PKO	100 All SSB
24	KW7J	100 Mixed
25	VE6JO	100 150 Mixed
26	WA4IUV	100 All SSB
27	W4ZFE	100 All SSB
28	N4KMY	100 Mixed
29	W0HBH	100 Mixed
30	K8KJN	100 All SSB
31	KG1V	100 All CW
32	K1KOB	100 Mixed
33	KY3F	100 75M SSB
34	PY2JY	100
35	YC5BEE	100 All SSB
36	YC5BEH	100 All SSB
37	WB9SBO	100 Mixed
38	N0AFW	100 150 200 Mixed
39	KA9MOM	100 All SSB
40	N3II	100 150 200 Mixed
41	W6DPD	100 All SSB
42	KE8GG	100 Mixed
43	VE6VK	100 Mixed
44	KD9RD	100 All SSB
45	W4WJJ	100 All SSB
46	K0HSC	100 All SSB
47	KI6GI	100 150 All SSB
48	IK1APP	100 150 All SSB
49	KJ4RR	100 All SSB
50	K8MDU	100 All SSB
51	N1EIU	100 All 20M SSB
52	K1DRN	100 All 20M SSB
53	WD8REC	100 All SSB
54	ZL2BLC	100 All SSB
55	VE3EFX	100 All SSB
56	W9MCJ	100 All CW
57	N6IV/KL7	100 Mixed
58	KN8D	100 Mixed
59	KC5YQ	100 All SSB
60	WB6ITM	100 Mixed
61	KA2AOT	100 150 All SSB
62	K4LHH	100 All SSB
63	VE2QO	100 All 20M SSB
64	KE5AT	100 All SSB
65	W9SU	100 Mixed
66	W3OOU	100 Mixed
67	NR2E	100 20M CW
68	KF5PE	100 Mixed
69	N3FBN	100 All 20M SSB
70	KB4SJD	100 All CW
71	N3EZX	100 All 20M SSB
72	IK8GCS	100 150 200 250All SSB
73	WB4I	100 All SSB
74	NG1S	100 All SSB
75	WB7UUE	100 All SSB
76	HK4EB	100 All 20M SSB
77	K0BFR	100 All 20M SSB
78	N7GMT	100 150 All SSB
79	AA4VN	100 Mixed
80	KA1LMR	100 All 20M SSB
81	N8AXA	100 All SSB
82	NM2I	100 All SSB
83	KD9YB	100 All SSB
84	HC2CG	100 All SSB
85	VE1BXI	100 All CW
86	YC2OK	100 All 15M SSB
87	N4GNL	100 All SSB
88	GM4UBF	100 All SSB
89	5Z4BP	100 All SSB
90	I0AOF	100 All RTTY
91	VE1BN	100 40M CW
92	KA2NRR	100 All SSB
93	5Z4DU	100 150 All SSB
94	KB8ZM	100 All SSB
95	HK4CCW	100 All SSB
96	W2JQ	100 All CW
97	HC2AGT	100 All 20M SSB
98	WD5N/M	100 All Mobile
99	VE1BHR	100 All SSB
100	VE1AGZ	100 All SSB

This rig's DXing days are over.

Wayne Green and Art Brothers testing the life out of a National 300. (New York City, 1958)

International List of DX Publications...

19 ways to keep in touch

The following is a list of DX-related publications that was compiled by Jim Maxwell W6CF.

The DX Family Newsletter

P O Box 12
Shinjukukita-Ochiai
Toyko 161 JAPAN

Comments: In Japanese
Seiji Takayanagi JH1FDP
The Japan DX News
P O Box 42 Urawa
Saitama 336 JAPAN

The DX Bulletin

Coverage: Amateur radio, DX
Published by: Chod Harris VP2ML
P.O. Box 50, Fulton CA 95439
Size: 8½" x 11", 4pp
Frequency: 50/yr

The DXers Magazine

Coverage: Amateur radio, DX
Published by: Gus Browning W4BPD
Frequency: Monthly
Subscription: $15.00/yr.

Inside DX

Coverage: Amateur Radio, DX
Published by: Arthur Hubert N2AU
436 N. Geneva St., Ithaca NY 14850
Size: 8½" x 14", 1 p.
Frequency: Weekly

The KH6BZF Report

Coverage: Amateur radio, propagation
Published by: Lee Wical KH6BZF
45-601 Luluku Rd., CRT #44-11
Kane'Ohe, Hawaii 96744-1854
Size: 8½" x 11", 2pp
Frequency: Weekly
Subscription: U S., Canada, Mexico $35 00/yr
Foreign $47.00/yr airmail

The Long Island DX Bulletin

Coverage: Amateur radio, DX
Published by: The Long Island DX Club
109 Willow Ave., Huntington NY
11743-4204
Size: 8½" x 14", 2pp.
Frequency: Bi-weekly
Subscription: U.S. $14.50/yr.

Long Skip

Coverage: Amateur radio, DX
Published by: The Canadian DX Association (CANAS-X)
PO Box 717, Stn. "O", Toronto, ON
M4T-2N7, CANADA
Size: 8½" x 11", 32pp
Frequency: Monthly
Subscription: Canada-CAD $20.00. All other countries $20.00 in U S funds. Includes 1st class mailing to Canada and U S airmail overseas
Comments: Subscription included with membership in CANAD-X

The Northern California DX Foundation Newsletter

Coverage: Amateur radio, DX
Published by: The Northern California DX Foundation
PO Box 2368, Stanford CA 94305
Size: 8½" x 11", 20pp
Frequency: 2/yr
Subscription: Worldwide - $25.00 first year, $10.00/yr thereafter
Comments: Subscription included with membership in the Northern California DX Foundation

QRZ DX

Coverage: Amateur radio, DX
Published by: Bob Winn W5KNE, PO Box 834072
Richardson TX 75083
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The DX News Sheet

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Comments: In English

DXPRESS

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The Netherlands
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VHF Bullentin

The Heard Island DX Association Newsletter

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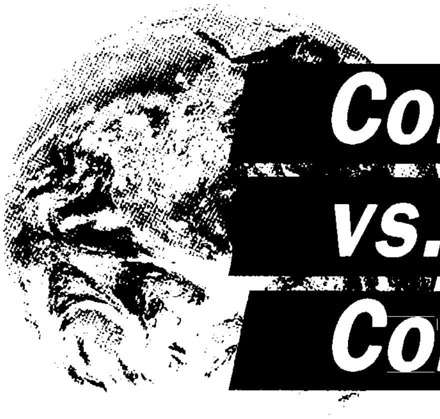
Published by: The Heard Island DX Association
PO Box 90, Norfolk Island, South Pacific
Size: 5¾" x 8¼", 16pp.

Les Infos du Clipperton DX Club

Coverage: Amateur radio, DX
Published by: The Clipperton DX Club
c/o Yannick Detalouche F6FYD
B P 8, F-78570 Andresy, FRANCE
Frequency: Quarterly
Subscription: $10.00/yr.
Comments: In French, some English. Subscription included with membership in the Clipperton DX Club

Les Nouvelles DX

Coverage: Amateur radio, DX
Published by: F6AJA
Size: 8¼" x 6"
Frequency: Bi-weekly
Comments: In French



Commodore 64/128 vs. US Department of Commerce

Easier DXing with Propagation Predictions

by Jim Cooper KD5EA

Solar flux is on the upswing of its eleven-year cycle, and hams can look forward to more and more good DX on the fifteen- and ten-meter bands. Back to the good old days of 1979, when the sun spot number was on the order of 140.2 (smoothed mean 10cm solar flux of 185). Receivers were wall-to-wall with S-9 signals on 10 and 15 meters from Europe, the South Pacific, Asia, and just about any place else. The long-awaited days of the sun spot high will soon return.

To take full advantage of the propagation to come, an operator must know which way to point the beam, and at what time of the day signals from any predetermined location will appear on the chosen band of operation.

Say, for instance, an operator in the city of Houston TX needs a station in France to complete the requirements for DXCC. On 12 September 1987, he tunes to WWV on 10 MHz at 18 minutes past the hour and hears the solar flux is 95, and the A-Index is 10. It would be nice to know the beam heading and time window in which signals from France are likely to be present along with an indication of the signal quality to expect. The following Commodore 128 program will do just what he wants. (It will run on the Commodore 64 with slight modification, too.)

What the Program Does

The program calculates:

1. The great circle azimuth and distance from the user's site to the desired distant location.
2. The HF MUF of the radio path of choice, in increments of one hour, for any 24-hour day, in UTC as well as local standard time.
3. Optimum Working Frequency (FOT, from the French "Fréquence Optimale du Travail"). This is figured from .85 x MUF, to allow for F-2 layer instability.
4. Expected signal quality.
   The program also prints the calculated data in hard copy form (Figure 1).

Program Input Requirements

1. The name of the local city and the distant city (for example: Houston, Paris).
2. The latitude and longitude of each location, obtained from maps, etc.
3. The day and month the prediction is for.
4. The Solar Flux and A-Index figures, from WWV at 18 minutes past the hour.

A word on the A-Index: The A-Index is an indication of the activity of the earth's magnetic fields. A magnetometer measures the activity in Gamma units on a scale from 0 to 400. When the A-Index is up to about 27, the 10- and 15-meter bands are quite noisy. Heaven forbid we should ever see a reading of 400!

In the program an A-Index of less than 10 indicates low ambient noise and excellent signal quality. Figures from 10–20 indicate good conditions, up to 25 is fair, and above 25 is poor. The user can change these figures in code lines 3950-4100 to suit their need.

KD5EA Program vs. Uncle Sam's

Basic MUF programs are fairly common in amateur radio publications. This program calculates FOT to conform better with the ionosphere radio propagation predictions issued by the US Department of Commerce in Boulder CO. It also features azimuth and distance calculations.

The following compares the data output of the Commodore 128 program to the data produced by the US Department of Commerce. The Department data is for January 15th, with a solar flux of 145 for the radio path from Boulder to St. Louis (see Figure 2).

The results from feeding the same variables into the Commodore 128 program:

1. Boulder, St. Louis
2. Lat./Long. of Boulder: 040.03,105.27
3. Lat./Long. of St. Louis: 038.67,090.25
4. Day and Month: 15,01
5. Solar Flux:145
6. A-Index: 10 (Not included in the Dept. of Commerce data).

The Commodore 128 produced the

```
RADIO PATH DATA FOR HOUSTON TO PARIS

THE PATH AZIMUTH IS:   44.52  DEGREES TRUE
THE PATH DISTANCE IS:  4816.4  STAT. MILES

DAY- :  12   MONTH:  9  SOLAR-FLUX:  95  SUN-SPOT #:  39.39

A-INDEX: 10

SIGNAL QUALITY:GOOD

TIME-UTC      TIME-CST      MUF      FOT

 0100          7PM          13.24    11.25
 0200          8PM          12.66    10.76
 0300          9PM          12.19    10.36
 0400          10PM         11.81    10.03
 0500          11PM         11.5     9.77
 0600          MIDNIGHT     11.25    5.56
 0700          1AM          15.8     13.43
 0800          2AM          15.75    13.42
 0900          3AM          15.14    12.86
 1000          4AM          14.6     12.41
 1100          5AM          15.64    16.69
 1200          8AM          24.49    20.81
 1300          7AM          26.05    22.14
 1400          8AM          26.31    22.36
 1500          9AM          26.37    22.41
 1600          10AM         26.23    22.25
 1700          11AM         25.89    22
 1800          NOON         25.32    21.52
 1900          1PM          24.49    20.81
 2000          2PM          23.33    19.83
 2100          3PM          21.67    18.41
 2200          4PM          18.98    16.13
 2300          5PM          14.75    12.53
 2400          6PM          13.93    11.84
```

Fig. 1. Tabular form of the Commodore 128 MUF program output.

data printed in Figure 3. Comparative analysis of the two data sets shows very little variance. The first variance is the 73.100 of one mile less in distance produced by the Commodore. This is due to the common trigonometric equations used in the Commodore program to calculate distance.

Figure 4 shows the MUF data in graph form. The "O"-line plot is for the US Dept. of Commerce; the "*"-line plot for the Commodore 128 figures. The Commodore 128 program varies somewhat from the DOC plot, but it's well within tolerable limits for HF communications propagation predictions.

This is proof that the Commodore 64/128 program measures up to the DOC program. Now for the programming.

Let's Get to Work

The following program code listing is for the Commodore 128, listed in Figure 5 (*see page 51*). When the program is ready to run, use the input data for Boulder to St. Louis. The data output should match the printout of Figure 3. Enter the input data as follows:

1. The name of City #1 followed by a comma (,) then the name of City #2.
2. The Lat. of City #1, followed by a comma (,) then the Long. of City #1. 40.03 N and 105.27 W is entered as 040.03,105.27. South Lat. and East Long. are entered with a minus (-) sign; for example, -006.00, -060.50.
3. Repeat Step 2 for City #2.
4. Enter two numbers for the day with a comma (,) then two numbers for the month. January 15 is entered as 15,01
5. Enter the Solar flux.
6. Enter the A-Index.

The printer should now print the azimuth and distance as well as the heading for the HF MUF data. At this point the program will pause for up to 45 seconds while the computer crunches the numbers. The computer then prints the 24-hour MUF and FOT.

Although there are many propagation prediction tables published in amateur magazines, and they do serve a need, they are monthly averages at best. This program accommodates the daily changes of the HF MUF.

JANUARY 15, 10 CM FLUX 145 (SSN 100)

BOULDER, COLO.	TO ST. LOUIS, MO.	AZIMUTHS		MILES	KM.
40.03N – 105.27W	38.67N – 90.25W	91.86	281.42	807.1	1298.8

MINIMUM ANGLE 2.0 DEGREES

UT	MUF	FOT	UT	MUF	FOT
01	14.0	11.1	07	8.5*	6.2
02	11.5	8.1	08	8.4*	6.8
03	9.5	7.5	09	8.3	6.7
04	8.0*	6.2	10	7.9*	6.1
05	8.2*	5.7	11	7.8*	5.2
06	8.4*	5.6	12	7.9*	4.9

UT	MUF	FOT	UT	MUF	FOT
13	8.8*	6.7	19	21.6	18.6
14	11.7	10.0	20	21.7	18.8
15	16.1	13.7	21	21.4	18.4
16	19.0	16.1	22	20.7	17.8
17	20.3	17.5	23	19.3	16.6
18	21.1	18.2	24	[illegible]	[illegible]

Fig. 2. Tabular form of MUF/Distance/Propagation quality data from the Dept. of Communications for the cities of Boulder CO and St. Louis MO on 15 January, 1987.

Comments, Please

I've experimented with this program over the past six months and learned that when the program indicates the FOT is above 21.450 MHz, and the A-Index is below 10, I have little problem hearing signals from selected locations on the 15-meter band. I'm very interested in the observations and comments of others using this program.

> "I'm very interested in the observations and comments of others using this program."

If you have a lot of trouble de-bugging your program, or you just don't like to type in that much program code, I will send you, for $20, a programmed and tested floppy disk. Each disk contains the HF MUF program for the Commodore 64, as well as for the C-128.

KD5EC resides at 1818 Riverwood Trail, Spring TX (77386) and has enjoyed amateur radio for many years.

References

1. National Bureau of Standards, WWV.
2. Nelson, J.H. *Propagation Wizard's Handbook*
3. Saveskie, Peter N. *Radio Propagation Handbook*

RADIO PATH DATA FOR BOLDER TO ST.LOUIS

THE PATH AZIMUTH IS: 81.88 DEGREES TRUE
THE PATH DISTANCE IS: 806.37 STAT. MILES

DAY- : 15 MONTH: 1 SOLAR-FLUX: 145 SUN-SPOT #: 98.87

A-INDEX: 23

SIGNAL QUALITY:FAIR

TIME-UTC	TIME-CST	MUF	FOT
0100	7PM	15.9	13.51
0200	8PM	11.96	9.82
0300	9PM	10.39	9.34
0400	10PM	10.51	8.93
0500	11PM	10.12	8.6
0600	MIDNIGHT	9.8	8.33
0700	1AM	9.93	9.1
0800	2AM	9.32	7.92
0900	3AM	9.1E	7.78
1000	4AM	9.02	7.66
1100	5AM	8.92	7.58
1200	6AM	8.83	7.5
1300	7AM	8.77	7.49
1400	8AM	13.77	11.7
1500	9AM	18.91	14.37
1600	10AM	18.49	15.71
1700	11AM	19.49	16.56
1800	NOON	20.12	17.1
1900	1PM	20.45	17.38
2000	2PM	20.53	17.45
2100	3PM	20.34	17.29
2200	4PM	19.89	19.9
2300	5PM	19.12	16.25
2400	6PM	17.91	15.22

Fig. 3. Tabular data generated by the Commodore program for the same input as in Figure 2.

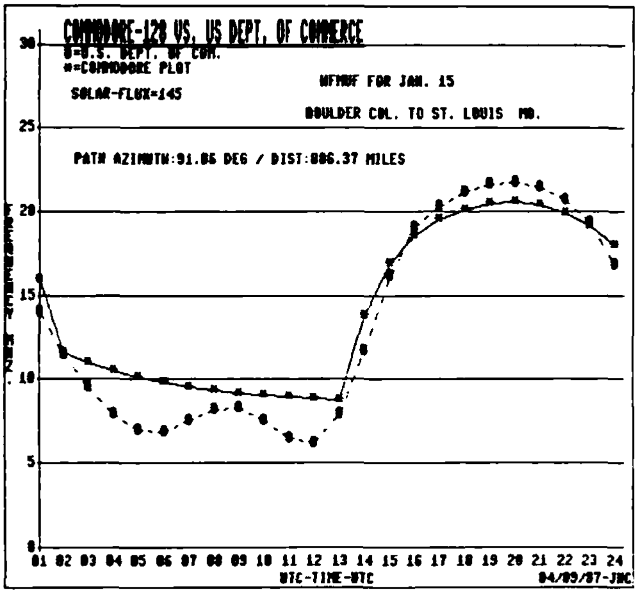


Fig. 4. Graph plot of data in Figures 2 and 3.

```
1000 Z$=CHR$(16)
1050 SCNCLR:FAST
1100 COLOR 5,1:COLOR 6,7
1150 B$=CHR$(18)
1200 PRINT B$"  GREAT CIRCLE BEARING/DISTANCE
     AND MAX-USABLE-FREQ PRGM":PRINT
1250 D=1:K=111.11:M=57.29577951:N=60:S=69.041:U$="######.#"
1300 OPEN 1,4
1350 PRINT
1400 PRINT" ENTER SOUTHERLY LATITUDES AS (-) VALUES":PRINT
1450 PRINT" ENTER EASTERLY LONGITUDES AS (-) VALUES":PRINT
1500 IF D<>1 THEN 1800
1550 PRINT "LOCATION OF TRANSMITTING (,) RECEIVING STATION
     (EXAMP:TEXAS,JAPAN)"
1600 INPUT"";T$,J$:PRINT
1650 PRINT" TRANSMITTING STATION LAT(N/S),LON(W/E)"
1700 INPUT"";A,L1:LL(1)=A:WW(1)=L1:A=A/M:PRINT
1750 PRINT" REVEIVING STATION LAT(N/S),LON(W/E)"
1800 INPUT"";B,L2:LL(2)=B:WW(2)=L2:B=B/M:PRINT
1850 L=(L1-L2)/M
1900 E=SIN(A)*SIN(B)+COS(A)*COS(B)*COS(L)
1950 D=-ATN(E/SQR(1-E*E))+1.57079
2000 C=(SIN(B)-SIN(A)*E)/(COS(A)*SIN(D))
2050 C=-ATN(C/SQR(1-C*C))+1.57079
2100 C=C*M
2150 IF SIN(L)<0 THEN C=360-C
2200 PRINT
2250 C=INT(C*100)/100
2300 X=INT(S*D*M*100)/100
2350 PRINT
2400 PRINT#1,"RADIO PATH DATA FOR "T$" TO "J$:PRINT#1
2450 PRINT#1,"THE PATH AZIMUTH IS: "C" DEGREES TRUE"
2500 PRINT#1,"THE PATH DISTANCE IS: "X" STAT. MILES":
     PRINT#1:PRINT#1
2550 A$=CHR$(17)
2600 B$=CHR$(18)
2650 C$=CHR$(19)
2700 D$=CHR$(29)
2750 E$=CHR$(145)
2800 F$=CHR$(147)
2850 DIM M$(37),A$(4),M(12),MU(25),FT(25)
2900 DATA 31,28,31,30,31,30,31,31,30,31,30,31
2950 FOR X=1 TO 12:READM(X):NEXT
3000 R0=π/180
3050 P1=2*π
3100 R1=180/π
3150 P0=π/2
3200 L1=LL(1)
3250 W1=WW(1)
3300 L2=LL(2)
3350 W2=WW(2)
3400 PRINT" DAY,MONTH"
3450 INPUT"";D6,M0:PRINT
3500 PRINT" SOLAR FLUX 70-250"
3550 INPUT"";SF:PRINT
3500 PRINT"A-INDEX:":PRINT
3650 INPUT"";AI
3700 L1=L1*R0
3750 W1=W1*R0
3800 S5=(-0.73+SQR((.73)^2-4*(.0008)*(65-SF)))/(2*.0008)
3850 S9=INT(S9*100)/100
3900 PRINT#1,"DAY= : "D6"  MONTH: "M0" SOLAR-FLUX:
     "SF" SUN-SPOT #: "S9:PRINT#1
3950 IF AI<10 THEN AI$="EXCELLENT"
4000 IF AI=>10 AND AI <= 20 THEN AI$="GOOD"
4050 IF AI>20 AND AI <=25 THEN AI$="FAIR"
4100 IF AI>25 THEN AI$="POOR"
4150 PRINT#1,"A-INDEX:"AI:PRINT#1
4200 PRINT#1,"SIGNAL QUALITY:"AI$:PRINT#1
4250 PRINT#1,Z$"07TIME-UTC"Z$"22TIME-CST"Z$"42 MUF";
     Z$"62 FOT":PRINT#1
4300 L2=L2*R0
4350 W2=W2*R0
4400 FOR T5=1 TO 24
4450 GOSUB 6200
4500 J9=J9+(1.5*LOG(J9)):J9=INT(J5*100)/100
4550 FT(T5)=J9*.85:FT(T5)=INT(FT(T5)*100)/100
4600 MU(T5)=J9
4650 NEXT T5
4700 PRINT#1,Z$"090100";Z$"247PM";Z$"41"MU(24);Z$"60"FT(24)
4750 PRINT#1,Z$"050200";Z$"248PM";Z$"41"MU(1);Z$"60"FT(1)
4800 PRINT#1,Z$"090300";Z$"249PM";Z$"41"MU(2);Z$"80"FT(2)
4850 PRINT#1,Z$"090400";Z$"2410PM";Z$"41"MU(3);Z$"60"FT(3)
4900 PRINT#1,Z$"090500";Z$"2411PM";Z$"41"MU(4);Z$"60"FT(4)
4950 PRINT#1,Z$"090600";Z$"24MIDNIGHT";Z$"41"MU(5);
     Z$"60"FT(5)
5000 PRINT#1,Z$"090700";Z$"241AM";Z$"41"MU(6);Z$"60"FT(6)
5050 PRINT#1,Z$"090800";Z$"242AM";Z$"41"MU(7);Z$"60"FT(7)
5100 PRINT#1,Z$"090900";Z$"243AM";Z$"41"MU(8);Z$"60"FT(8)
5150 PRINT#1,Z$"091000";Z$"244AM";Z$"41"MU(9);Z$"60"FT(9)
5200 PRINT#1,Z$"091100";Z$"245AM";Z$"41"MU(10);Z$"60"FT(10)
5250 PRINT#1,Z$"091200";Z$"246AM";Z$"41"MU(11);Z$"60"FT(11)
5300 PRINT#1,Z$"091300";Z$"247AM";Z$"41"MU(12);Z$"60"FT(12)
5350 PRINT#1,Z$"091400";Z$"248AM";Z$"41"MU(13);Z$"60"FT(13)
5400 PRINT#1,Z$"091500";Z$"249AM";Z$"41"MU(14);Z$"60"FT(14)
5450 PRINT#1,Z$"091600";Z$"2410AM";Z$"41"MU(15);
     Z$"60"FT(15)
5500 PRINT#1,Z$"091700";Z$"2411AM";Z$"41"MU(16);
     Z$"60"FT(16)
5550 PRINT#1,Z$"091800";Z$"24NOON";Z$"41"MU(17);
     Z$"60"FT(17)
5600 PRINT#1,Z$"091900";Z$"241PM";Z$"41"MU(18);Z$"60"FT(18)
5650 PRINT#1,Z$"092000";Z$"242PM";Z$"41"MU(19);Z$"80"FT(19)
5700 PRINT#1,Z$"092100";Z$"243PM";Z$"41"MU(20);Z$"60"FT(20)
5750 PRINT#1,Z$"092200";Z$"244PM";Z$"41"MU(21);Z$"60"FT(21)
5800 PRINT#1,Z$"092300";Z$"245PM";Z$"41"MU(22);Z$"60"FT(22)
5850 PRINT#1,Z$"092400";Z$"246PM";Z$"41"MU(23);Z$"60"FT(23)
5900 PRINT#1:PRINT#1:PRINT#1:PRINT#1
5950 PRINT#1,Z$"34 END-OF-DATA"
6000 PRINT#1:PRINT#1:PRINT#1:PRINT#1
6050 SCNCLR
6100 CLOSE 1
6150 END
6200 K7=SIN(L1)*SIN(L2)+COS(L1)*COS(L2)*COS(W2-W1)
6250 IFK7=>-1THEN6400
6300 K7=-1
6350 GOTO6500
6400 IFK7<=1THEN6500
6450 K7=1
6500 G1=-ATN(K7/SQR(-X7*X7+1))+π/2
6550 K6=1.59*G1
6600 IFK6>=1THEN6700
6650 K6=1
6700 K5=1/K6
6750 J9=100
6800 FORK1=1/(2*K6)TO1-1/(2*K6)STEP0.9999-1/K6
6850 IFK5=1THEN6950
6900 K5=.5
6950 P=SIN(L2)
7000 Q=COS(L2)
7050 A=(SIN(L1)-P*COS(G1))/(Q*SIN(G1))
7100 B=G1*K1
7150 C=P*COS(B)+Q*SIN(B)*A
7200 D=(COS(B)-C*P)/(Q*SQR(1-C^2))
7250 IFD>=-1THEN7400
7300 D=-1
7350 GOTO7500
7400 IFD<=1THEN7500
7450 D=1
7500 D=-ATN(D/SQR(-D*D+1))+π/2
7550 W0=W2+SGN(SIN(W1-W2))*D
7600 IFW0=>0THEN7700
7650 W0=W0+P1
7700 IFW0<P1THEN7800
7750 W0=W0-P1
7800 IFC=>-1THEN7950
7850 C=-1
7900 GOTO8050
7950 IFC<=1THEN8050
8000 C=1
8050 L0=P0-(-ATN(C/SQR(-C*C+1))+π/2)
8100 Y1=0.0172*(10+(M0-1)*30.4+D6)
8150 Y2=0.409*COS(Y1)
8200 K8=3.82*W0+12+0.13*(SIN(Y1)+1.2*SIN(2*Y1))
8250 K8=K8-12*(1+SGN(K8-24))*SGN(ABS(K8-24))
8300 IFCOS(L0+Y2)>-0.26THEN8800
8350 K9=0
8400 G0=0
8450 M9=2.5*G1*K5
8500 IFM9<=P0THEN8600
8550 M9=P0
8600 M9=SIN(M9)
8650 M9=1+2.5*M9*SQR(M9)
8700 GOTO10050
8800 X9=(-0.26+SIN(Y2)*SIN(L0))/(COS(Y2)*COS(L0)+.001)
8850 K9=12-ATN(K9/SQR(ABS(1-K9*K9)))*7.639437
8900 T=X8-X9/2+12*(1-SGN(K8-X9/2))*SGN(ABS(K8-K9/2))
8950 T4=K8+K9/2-12*(1+SGN(K8+K9/2-24))*SGN(ABS(K8+K9/2-24))
9000 C0=ABS(COS(L0+Y2))
9050 T9=9.7*C0^9.6
9100 IFT9>0.1THEN9200
9150 T9=0.1
9200 M9=2.5*G1*X5
9250 IFM9<=P0THEN9350
9300 M9=P0
9350 M9=SIN(M9)
9400 M9=1+2.5*M9*SQR(M9)
9450 IFT4<TTHEN9600
9500 IF(T5-T)*(T4-T5)>0THEN9650
5550 GOTO10300
9500 IF(T5-T4)*(T-T5)>0THEN10300
9650 T6=T5+12*(1+SGN(T-T5))*SGN(ABS(T-T5))
9700 G9=π*(T6-T)/K9
9750 G8=π*T9/X9
9800 U=(T-T6)/T9
9850 G0=C0*(SIN(G9)+G8*(EXP(U)-COS(G9)))/(1+68*G8)
9900 G7=C0*(G8*(EXP(-K9/T9)+1))*EXP((K9-24)/2)/(1+G8*G8)
9950 IFG0=>G7THEN10050
10000 G0=G7
10050 G2=(1+S9/250)*M9*SQR(6+58*SQR(G0))
10100 G2=G2*(1-0.1*EXP((X9-24)/3))
10150 G2=G2*(1+(1-SGN(L1)*SGN(L2))*0.1)
10200 G2=G2*(1-0.1*(1+SGN(ABS(SIN(L0))-COS(L0))))
10250 GOTO 10600
10300 T6=T5+12*(1+SGN(T4-T5))*SGN(ABS(T4-T5))
10350 G8=π*T9/K9
10400 U=(T4-T6)/2
10450 U1=-K9/T9
10500 60=C0*(G8*(EXP(U1)+1))*EXP(U)/(1+G8*G8)
10550 GOTO10050
10600 IFG2>J9THEN10700
10650 J9=62
10700 NEXTK1
10750 J9=.93*J9
10800 6=1:RETURN
```

Fig. 5. Listing for the Commodore 64/128 MUF/Distance/Propagation Quality generator program.

CIRCUITS

Number 21 on your Feedback card

Great Ideas From Our Readers

Many readers will recognize the revival of this regular feature, which has been absent from the pages of *73* for several years. We welcome brief contributions of circuits. If your idea is published, you will receive a free subscription or a renewal. Clearly indicate that your submission is for this column and not a manuscript for an article.—Ed.

LOW COST REPEATER CONTROLLER

Like most hams, we are cheap. This controller can be built for less than $30. It has only 6 chips excluding the output buffer/driver, 8 passive components, and 8 latched outputs. It will automatically reset its sequence should a wrong digit be received or an entry window timer elapse.

The decoder for the controller is a SSI202P chip available from Radio Shack for $12.95. It has a binary ouput and all audio filtering and processing is done internally. Other parts of the controller include a sequencer, a digit comparator, a quad NANDgate with Schmitt inputs and an addressable latch.

PREFIX SELECTION:

The "1st, 2nd, 3rd" inputs of the 74LS54 are hard-wired to the appropriate outputs of the 4028 decoder.

OPERATION:

A small audio signal enters the touch-tone chip on pin 9. Should the decoder determine that the audio is a valid touch tone, it will put the binary equivalent on the output bus. Pins 1,18,17,16 then pull data valid high. The binary data will be converted to one of ten with the 4028 chip. The data valid will appear on the clock input of the 4017 sequencer chip. Its "zero" output (idle state) will go inactive (low) starting the 4 second window timer (R1, C1). The "one" output of the sequencer will activate, enabling the first digit comparator (74LS54). Pin 6 will show the results of the comparison, low = match, high = no match. When the tone stops, data valid will go low and a pulse generated by one shot R3,C3 will allow the sequencer to be reset in the event of a bad digit. The binary data will remain on the buss for at least 40ms.

This process will continue until the prefix is properly entered or the window timer times out. On step four of the sequence, pin 13 of the 4093 will enable and the binary data of the last digit will form an address and data bit on the input to the 4099 addressable latch. The LSB of the data will determine if the addressed latch will be set or reset. When the last tone is released the one-shot C3-R3 will enable Pin 12 of the 4093 and tell the 4099 to read its inputs, thus setting or resetting the appropriate latch. This last digit is always determined to be bad and will reset the sequencer so it will be ready for the next function. There is enough propagation delay so that the 4099 will do its job before the reset occurs. Should a false tone initiate a sequence or an operator abort a control function, the sequencer will reset after the window time.

Example, prefix = 123

FUNCTION:

	Set	Reset	
0	1231	123D	The codes
1	1233	1232	come out a
2	1235	1234	little weird,
3	1237	1236	but how much
4	1239	1238	can you expect
5	123•	1230	6 chips to do?
6	123A	123#	
7	123C	123B	

CONSTRUCTION:

The controller is easily built with wire wrap construction on less than four square inches of board. All passive components can be mounted on a single dip header.

PARTS LIST:

1	CD4093
1	10 meg ¼w
1	18 pin ww socket
1	CD4099
1	2.2 meg ¼w
4	16 pin ww socket
1	CD4028
1	33k ¼w
2	14 pin ww socket
1	CD4017
1	2.2 uF
1	16 pin dip header
1	74LS54 / 74L54
2	0.01 uF
1	SSI202P
1	3.579 mHz crystal
1	1N914 / 1N4148 diode

OPTIONS:

1. A CD4514 can be substituted for the CD4028 so that any of sixteen touch-tone can be included in the prefix. Note: touch-tone 0 = binary A and T.T. D = binary 0.

2. For a four-digit prefix use pin 12 of 74LS54 for strapping 4th digit, connect pin 13 to pin 10 (step 4) of 4107 and connect pin 4 (step 5) of 4017 to pin 13 of 4093.

3. Data valid indicator as shown, LED driver is 74L04 or MPSA13 darlington with 30k base resistor.

4. Output buffers: The CD4099 will drive 2 74LXX or 1 74LSXX chip. Sink or source about 0.8 ma. 74LS04 or darlington transistors can be used to drive small relays or solid state relays.

—Darryl Rowles N1AAQ
Auburn ME 04210

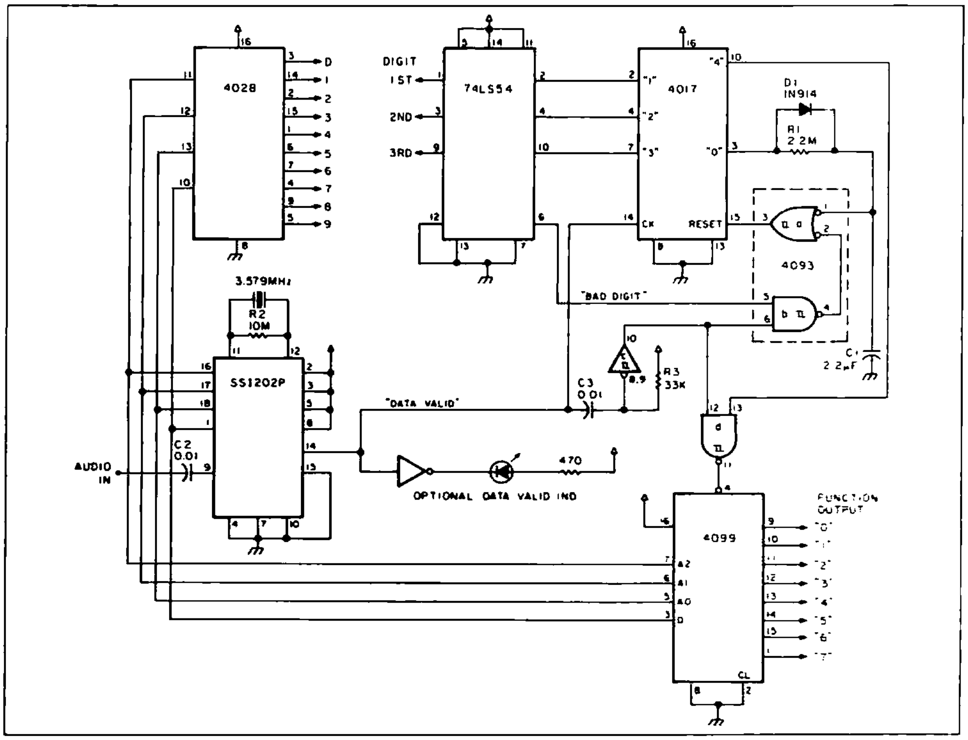


Figure 1. Low cost repeater controller.

Number 22 on your Feedback card

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B
3353 Fieldstone Dr.
Doylestown PA 18901

WILD, WONDERFUL 6 METERS

We're well on our way into sunspot cycle #22! Only time will tell how intense its effects will be, and we can only speculate on the possibilities for DX on 50 MHz. Some amateurs are already looking into their crystal balls and making some very interesting predictions based on events observed during the 1987 Es season.

Mid-Atlantic VHF Conference: One dire prediction is that 50.110 MHz—the calling frequency for 6 meters—will become a virtual Tower of Babel during the long-haul F2 openings to Europe, Japan, and Africa that are most certain to occur in the next few years. As in the past, voices are calling out for a designated DX window somewhere in the range of 50.080 to 50.200 MHz. And these "seers" have a point, as many countries not heard from before are exercising newly-won privileges on the band. Such countries include Great Britain, Norway, and perhaps even Holland.

With this in mind, I sat in as a guest panelist and represented 73 at the recent Mid-Atlantic VHF Conference, sponsored by the Mt. Airy VHF Radio Club. Also present were Joe Reisert W1JR of Ham Radio, Steve Katz WB2WIK of CQ Magazine, and Bill Tynan W3XO of QST. The topic? A proposal for a 6-meter DX window. The moderator was Rick Connor WB2NPE, long an active VHFer and conversant about 6 meters. Herb Spoonts W3IWU, a long-time veteran on 6, also sat on the panel.

Over 150 persons attended this conference, and most made it a point to sit in on this panel. A variety of comments were heard, and it should come as no surprise that no consensus of any kind was reached! The entire point of this panel was to stimulate the discussion necessary to make an intelligent decision whether or not to have such a calling frequency, and where to have it.

For those readers not familiar with 6m, conditions of enhanced long-haul F2 propagation can be so intense that a mere 3 Watts and a whip antenna will get you across the USA and even into some other countries. But you might have a real hard time working a comparatively weak station from, say, Wales, if a local station is running over 1 kW nearby and desensing your receiver. Witness the weekend of the 1987 June VHF QSO Party, when hundreds of 6-meter stations in the USA ran high power congregated around 50.110 MHz. Stations from as far away as the 5th call area were being heard loud and clear in Great Britain and Portugal, but not vice-versa! Many stateside operators lost out on good DX and rare grid squares.

Power restrictions placed on many European operators compounds the problem. Great Britain stations are limited to a maximum of 100 Watts ERP—equivalent to running 20 Watts into a 7-dB antenna. Not much to work with, yet some operators in both Canada and the US have managed to work hundreds of these low-power stations.

DX Window?

According to my notes, the majority at the meeting favored a DX window of some sort. How to implement it was another story altogether! Many comments hinged on the increased use of CW and the establishment of a CW segment between 50.080 and 50.100 MHz, with US and Canadian stations calling outside this window and working split. Other amateurs suggested setting aside the entire segment from 50.100—50.125 for DX, with a gentlemen's agreement enforcing the window—especially during contests.

Most amateurs present felt that the problem existed only during contest periods, and specifically during the June event. They felt that DX and stateside stations would figure out a way to find a clear frequency if they wanted to contact badly enough. The problem is at its worst during a contest, yet that is precisely the time when you might have the best chance to work the most DX stations. The activity level draws out the DX, especially when conditions are favorable.

The point was raised that Japanese stations raised from the West Coast often use CW for their contacts, owing to the relatively weak signals and strong regional accents. The JA1UT operation to mainland China recently used split-frequency operation with a great deal of success. Another problem raised is that many DXpeditions are severely limited to the frequencies that can be used on 6 meters. Only in some cases do frequencies fall within the proposed window of 50.100–50.125. In others, the only place to go is above 53 MHz, which may be higher than the MUF during an opening!

Conference Outcome

I counted over 40 separate comments on this proposal, and the responses ran the gamut. These are the consenses, however, in brief:

•There is a real need for a DX window, protected from US and Canadian stations.

•Persons making contacts on 50.110 MHz should promptly QSY to another part of the band. This would likely involve split-frequency operation, similar to that in use on 160m, and also common to 40-meter operation during contests.

A few well-versed six-meter operators dissented, saying that a window would close out too many operators. All present, however, felt that hams can enforce a window. Amateurs also asked just what is DX on 6 meters. They pointed out that stations in Florida and the Gulf Coast can work into the Caribbean without much difficulty, but those same stations would be a real DX find for stations in the northeast, midwest, and west!

The issue also came up at the Central States Conference, and I expect there'll be a lot more discussion over the next year or so. I'll try to keep you informed of others' opinions, but be advised that all of this is probably building up to a request to the ARRL Contest Advisory Committee (CAC) to create a DX window for their 3 major contests in January, June and September. As a member of the CQ VHF WPX Committee, I think that a similar rule will be adopted in the near future, based on feedback from participants this past July.

My own opinion? Quite simply: A DX window is an excellent idea during contests, when the band is loaded with stations running lots of power, all parked on or around 50.110 MHz. I don't think it's necessary at any other time since operating skill should enable stateside and DX stations to find each other. If DX stations were allowed to run the power that we are, no window would be needed at all.

More New Products

I recently spoke with two very active amateurs during the Hamarama and Conference. One was Bill Olsen W3HQT who runs Down East Microwave in Troy, Maine. Bill has manufactured a line of loop yagis for several years, and can get you set up on 903, 1296 or 2304 MHz in a hurry! Bill also designs and builds solid-state gain blocks for these bands, with current production models available to run 16 or 32 Watts on 1296 MHz.

Bill also carries the LMW line of transverter kits from England. These kits are based on building blocks, such as transmit and receive mixers, local oscillator (LO) boards, and RX/TX gain stages. I decided to take the plunge and get on 2304 with the LMW kit and housing. It consists of the LMW Universal Local Oscillator (which I found is almost impossible to screw up when finished), a Transmit Mixer with 500-mW output, receive mixer, GaAsFET preamplifier, and 144-MHz i-f amplifier. In addition, you'll need 13.8 VDC to make it all work, and an enclosure to put it all in.

I hope to have this unit up and running by the January Sweepstakes. There are at least six other amateurs in my area active on 13cm. Wiring is fairly critical at this frequency, and SMA connectors are the choice, except at the antenna, where a Type N is employed. LMW also makes these units assembled in a neat little package with a power meter and sequencer for 1296 and 2304. Prices run into the $500 range for a 6-Watt unit on 1296 and 2 Watts on 2304. I've been assured by Bill that 903 models are forthcoming. Send for the catalog at Down East Microwave, Box 2310 RR #1, Troy ME 04987 (207/948-3741).

Another member of the Mt. Airy Club is Dave Mascaro WA3JUF who operates a business called Frontier Microwave. Dave is an accomplished RF designer and a true PackRat, and has come out with a line of microwave amplifiers for 903, 1296, 2304 and even 3456 MHz. These are available in both Class C and Class A (linear) models, with the Class C types typically having more gain. Most of his amplifiers require 24–28 VDC (no problem there) for Class

C operation, while the linear types will typically need both 26 and -5 VDC supplies, the latter used for bias.

All of Dave's designs function in the grounded-base mode and the -5 volt supply is used for emitter bias (similar to cathode bias on a 7289/3CX100). Dave suggests using a 6-volt gel-cell as the bias supply and has done so many times while portable. None of these designs are switchable—you must devise some sort of antenna switching and input switching scheme. Typically you'd drive the output of your 23cm or 13cm mixer directly into the amplifier and use one SPDT relay at the antenna to select the amplifier or receiver. Such a relay should use low-loss connectors and be intended for microwave applications. Type N or SMA types should work, but be careful in your selection. Dow Key Type—60 relays aren't always 50 Ohms at 1296, and look out at 2304!

Dave also makes switched 30-Watt amplifiers for 144 and 220 MHz, both of which have preamplifier options available. I've seen examples of the 1296 and 2304 amplifiers and the workmanship is excellent. They are available in power ranges from 10 mW to 30 Watts on 23 cm, and from 10 mW to 20 Watts on 13 cm. If you are looking for intermediate stages or a medium-power solid-state "brick" for the microwave bands, drop Dave a line at Frontier Microwave, RD1 Box 467, Ottsville PA 18942 (or call in the evenings at 215/795-2648).

I've also gotten a product announcement from Hi-Spec of Jupiter, Florida, which mentions their new line of cavity assemblies for 2304 MHz. Two designs are offered: The first, Model 13G1, accommodates a single 7289, running from 25–50 Watts at about 10–13dB gain. The Model 13G2 will take two tubes, and runs from 50 to 100 Watts in a 6–13dB configuration, depending on bias. I assume these are just cavity assemblies and you will need to make up a power supply, a bias supply and come up with a blower. Contact Hi-Spec at PO Box 387, Jupiter FL 33468 (305/746-5031).

New Year's Resolutions

I'll close this month by planting a few seeds for 1988. Call them New Year's resolutions if you will, but give these ideas some thought:

"There is a real need for a DX window, protected from US and Canadian stations."

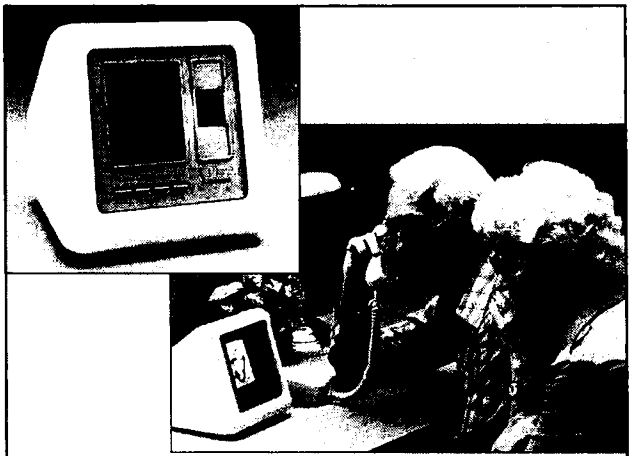
(1) Try to run at least one major contest if you've never done it before—just to see what you can work when the bands are hopping.
(2) Try to build at least one item for your VHF/UHF station, whether it be a preamp, sequencer, amplifier, antenna array, or power supply. Keep those hands busy!
(3) Pick up a copy of one of the proceedings from the many VHF/UHF conferences held around the country, such as Central States or Mid Atlantic. Read it. See if something doesn't jog your interest or prompt you to write a letter (or better yet an article!) about that topic. The ARRL is publishing most of these proceedings and the price is reasonable—about $10 each.
(4) Get involved with other VHF/UHF enthusiasts in your area. Why not start up a club if one doesn't already exist? I know of at least two major organizations that came into being in 1987 (North Texas Microwave Society and Midwest VHF Society) as a result of interested hams getting together and trading ideas.
(5) If you've used some piece of VHF or UHF equipment reviewed or advertised in this magazine and have strong opinions about it, write me! I want to hear them.
(6) Use the many propagation beacons that someone has spent considerable expense to get on the air. They're your 24-hour sentry, watching for that elusive 2m opening that might bring VUCC . . . a new state on 1296. . . DX on six meters.

With that last sentence, we've come full circle. I'll be looking for many of you during the January VHF Sweepstakes. Good luck, best DX, and see you next month. Above and Beyond! 73

Number 23 on your Feedback card

NEW PRODUCTS

Compiled by Rebecca Niemela



The VisiTel from Mitsubishi's Visual Telecom Division. (2 photos)

MITSUBISHI

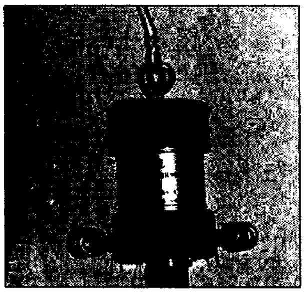
Mitsubishi and its Visual Telecom Division announced the introduction of the **Mitsubishi VisiTel* Visual Telephone Display**, the first still-frame visual telephone specifically designed for home use.

The practical and affordable ($399 suggested retail price) VisiTel puts exciting new picture phone technology within the reach of the average consumer. The unit features a built-in video camera and a 4.5 inch (diagonally measured) monitor, enabling the user to send and receive freezer-frame black and white "video snapshots" over standard telephone lines.

The VisiTel works in tandem with any home telephone equipped with a modular phone plug. As easy to install as an answering machine, the unit plugs into a regular AC outlet and home phone jack, and requires no special wiring or phone line.

For more information contact Mitsubishi Visual Telecom Division, 3350 Scott Blvd, Bldg. 49, Santa Clara CA 95054 (408/970-9555). Or circle Reader Service Card #201.

* "VisiTel" is a trademark of Mitsubishi Visual Telecom Division.



Antenna balun from Antenna Systems.

ANTENNA SYSTEMS

Antenna Systems has introduced a new antenna balun which includes a feature not found on any other balun. This feature is called Antenna Feedline Protectorcoptrt. Antenna Feedline Protector© prevents your coaxial cable from breaking off your antenna by removing the strain from the connector. It does this through a specially designed strain relief.

The K2RAG Balun covers the frequency range ofrom 1.8 to 32 MHz, is made of rugged ABS plastic and includes all stainless steel fittings. It handles 2KW PEP transmitting power. There are two models available. Also included as standard features are static protection, center fed support hanger and low weight. K2RAG Baluns are also available as part of fully-assembled dipoles and end-fed antennas for each of the popular HF bands. K2RAG antennas are precut for the CW portion of the band and are also marked for the phone portion.

For more information write to Antenna Systems Inc., 14465 SW Hazelhill Drive, Tigard OR 97224 (503/684-5350) or circle Reader Service Card #213.

Free Catalogs.

CATALOGS...CATALOGS

SIMPSON ELECTRONICS

A new 8-page, 2-color catalog featuring low-cost test equipment was released by the Mercer Electronics Division of Simpson Electronic Company.

The catalog features the company's full line of products, including its recently announced new multifunction frequency counters and 2 MHz sweep/function generator. Other products featured include 3½ and 4½ digit hand-held DMMs; a Volt-Ohm-Ammeter; a high accuracy, full range capacitance tester; and a variety of other digital instruments and probes.

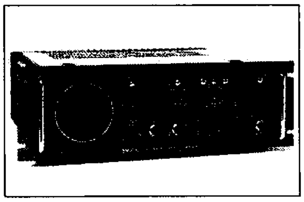
The product line is carried in stock at electrical and electronic distributors nationwide.

This catalog is available at no charge from your electronic distributor or by contacting Mercer Electronics, 859 Dundee Avenue, Elgin IL 60120-3090 (312/697-2260) or circle Reader Service Card #206.

CONTACT EAST

Contact East's latest catalog contains many new and innovative items for service engineers, manufacturing engineers, technicians, and electronic hobbyists. A full section of test instruments; the latest in static and contamination protection; inspection aids; data and telecommunication equipment; electronic adhesives; soldering supplies; Contact East's exclusive line of tool kits and an extensive section devoted to precision hand tools are just some of the products featured in this issue.

To receive your free full-color copy, plus a complementary year's subscription, write to Contact East, P.O. Box 786, North Andover MA 01845; 617-682-2000. Or circle Reader Service Card #207.



ICOM's UX-14 Converter.

NEWS FROM ICOM

The **UX-14 Converter** enables you to adapt a CI-IV system to a CI-V system. This allows the transceiver to be computer controlled, or for satellite operations using the CT-16 Satellite Interface Unit. The following radios are equipped with a CI-IV port and can be converted for CI-V use with the UX-14: IC-R71A, IC-271A, IC-271H, IC-471A, IC-471H, IC-751, IC-751A and IC-1271A. Suggested price is $73.

To complement the growing activity on 220MHz, ICOM now has a 220MHz repeater available, the **RP-2210**. With frequency coverage from 216-236 MHz, selectable CTCSS/Carrier squelch operating system, and 25 watts RF output power, DTMF control and continuous duty cycle. The RP-2210 is a great way to get out of the mainstream activity. Suggested price is $1500.

This mini-sized speaker mic is big on audio. . . the **HM-46** for top panel connection on the IC-2AT, IC-02AT. IC-3AT, IC-03AT, IC-4AT and IC-04AT and the HM-46L right angle connection speaker mic for the Micro series. Both the HM-46 and HM-46L have a swivel clip on the back to easily clip on your lapel or collar. Suggested price is $30.

For information on all of these ICOM products, contact ICOM America, Inc., 2380-116 Ave. N.E., Bellevue WA 98009 (206/454-8155).

Number 24 on your Feedback card

BARTER 'N' BUY

QSLs To Order. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

The DX'ers Magazine Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate 2-4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

Xerox **MemoryWriter**—parts, assemblies, boards, manuals. Free help with service problems. W6NTH, Box 250, Benton AR 72015 501-776-0920. BNB404

Learn Code on your IBM PC (or compatible), Commodore C-64/128, or 512K Macintosh. CODE-PRO takes you from no knowledge to proficient copy. Specify computer. $10 plus $2 p&h. Trio Technology, Dept. 861, PO Box 402, Palm Bay FL 32906. BNB490

Post Card QSL Kit Converts post cards, photos to QSLs! Stamp brings circular K-K Labels, PO Box 412, Troy NY 12181-0412. BNB498

Commodore Chips Authorized Distributor, Factory Fresh. #6526/6510-$9.95, #6581-$12.85, #6567-$14.75, #8701-$7.25, PLA/82S100-$12.50, 901225/226/227/229-$10.95 and many others. Ask about quantity discount. (We Ship Worldwide) .....Heavy Duty Power Supply for C64-$27.95 .....VISA/MC .....Call Toll Free 800-248-2983 (outside NY) or 914-356-3131. Kasara Microsystems, Inc., 38 Murray Hill Drive, Spring Valley NY 10977. BNB529

2.4 KHz AM Demodulator with 8 bit A-D and buffer. Copy WEFAX From GOES SATELLITES or APT From NOAA POLAR ORBITING SATELLITES. Created for use with Elmer Schwittek's Multifax 2.0 program. Order #206-KIT $49.95 or assembled and tested board Order #206-ASY $69.95. Add $2.50 Shipping per order. A&A Engineering, 2521 W. LaPalma, Unit K, Anaheim CA 92801 (714/952-2114). BNB531

Ham Radio Repair, all makes, all models. Robert Hall Electronics, PO Box 8363, San Francisco CA 94128 (408)729-8200. BNB558

SB-220 Owners!—Enhance performance—add new features. 11 step-by-step mods which include: tuned-input 6- and 160-meter operation, heavy-duty power supply mods, full QSK operation, solid-state bias control, and many more. Source of parts included. One time 50% rebate for new mods submitted and two free updates. 10 pages of tech info on the 3-500Z. Order today—$10 per copy plus $1 postage. SASE for info. Bob Kozlarek WA2SQQ, 69 Memorial Place, Elmwood Park NJ 07407. BNB581

Commodore Repairs. We are the largest Authorized Service Center in the country and we repair your Commodore computer within days. (our prices are low; eg. C64-$39.95 complete) ....."THE COMMODORE DIAGNOSTICIAN", an invaluable double-sided laminated guide for fixing your C64/1541 drive. It diagnoses 72 variables and tells you what chips are faulty. $6.95 plus $1.00 postage ... C-64 Power Suply $27.95 .... VISA/MC .....Call Toll Free 1-800-248-2983 (outside NY) or 914-356-3131. Kasara Microsystems, Inc., 38 Murray Hill Drive, Spring Valley NY 10977. BNB587

Wanted: Lafayette PrivaCom 3C, 525, 625, or GE 5813B. RADIO, 2053 Mohave Dr., Dayton OH 45431. BNB589

MARCO: Medical Amateur Radio Council, operates daily and Sunday nets. Medically oriented amateurs (physicians, dentists, veterinarians, nurses, therapists, etc.) invited to join. For information, wrtie MARCO, Box 73's, Acme, PA 15610. BNB612

Wanted. Drake R7A Receiver Tony Ficarra, 144 Gladstone Avenue, Wollongong, NSW, Australia 2500, Phone (042) 29 2573. BNB615.

DX Adventure on Monserrat only $300/week. Details: Chod Harris VP2ML Box 4881-7, Santa Rosa, CA 95402. BNB618

Superfast Morse Code Supereasy. Subliminal cassette. $10. Learn Morse Code in 1 Hour. Amazing new supereasy technique. $10. Both $17. Moneyback guarantee. Free catalog: SASE. Bahr, Dept. 73-8, 2549 Temple, Palmbay FL 32905. BNB624

Homebrew Projects List. SASE WB2EUF, Box 708, East, Hampton, NY 11937. BNB626.

Dead Battery Pack??? NiCds/ Inserts / Rebuilding. AA $1.60 (W/Tabs $1.75), 2/3AA 270mAh $1.95, 2/3AF 450mAh $2.45, Replacement inserts, less wires/plugs; ICOM BP2 $17.95, BP3 (original) $16.95, BP5 $23.95, Kenwood TR 2400 $18.95, PB25 $22.95, PB25H/26 $24.95, Tempo; S1/270mAh $19.95, S1,2,4,5 /450mAh $22.95, Azden 300 $18.95. Ten-Tec 2991 $24.95, Santec 144 (8N 500AA) w/plug $19.95 Others, Info/rebuild quotes, SASE. In PA add 6%. Add $2 S and H/order. Cunard Associates, R.D. 6 Box 104, Bedford PA 15522. BNB628

Antenna Traps designed quickly and accurately with your computer. Send $10 for APPLE or IBM-PC program disk and manual, SASE for more information. W1HUE, 119-7 Buckland St., Plantsville CT 06479. BNB630

Back Issues 73 Rare Price Sale. 1977 to 1986. Each twelve issue volume costs $50 plus $3 postage. Send check or money order to A.E. Fant, WB5WAF/DA1FT, Schweinfurt American JHS, APO NY NY 09033. Hurry, I need the space. BNB634

QSLs, QSLs, Rusprint QSLs, Quantities of 100, 200, 300 or more. Full color Old Glory and Cartoon. Also Parchment, Golden Eagle, and others. SASE appreciated. Rusprint, Rte 1, Box 363-73, Spring Hill KS 66083. BNB643

Attention!!! Any amateur radio operators interested in forming a new type of amateur radio club. For information please send $2 to cover postage to KA3RET P.O. Box 96, Uniontown, PA 15401. BNB645

R-390A Receiver: $115, electronically complete, reparable (Government-removed meters, operation unaffected). R-390A parts: Info SASE. Professional quality TS-352 Voltohm/Mutimeter, AC-DC, with leads, manual: $12.50. Mint military-spec pull out 12AT7, 6BA6, 6BA6, 6AG5, 6AL5: $10/six. CPRC-26 Infantry Manpack Radio, 6 meter FM, Receiver-Transmitter sections, cabinet, antenna, crystal, handset: $22.50, $42.50/pair. H-251 Military Communications Headphones: $7.50. Add $4.50/piece shipping ($9 maximum), except R-390A shipped collect. Baytronics, Box 591, Sandusky OH 44870. BNB649

New Quick Charge "AA" NiCds Ten for $11.00 plus shipping. "AAA" NiCds just $1.65 each. "C" or "D" size NiCds just $3.00 each. Universal NiCd Charger just $9.99 Amphenol PL-259 Connectors just 80 cents each. R. Richard, 1787 Village Green Dr., Clairton PA 15025; 412-655-7494. BNB650

Amateur Radio Stamps for collectors. Israel $5. Luxembourg $1.50. Send SASE for complete list to Phil Sager WB4FDT, 126 Whiting Lane, West Hartford CT 06119. BNB651

Kenwood TS940 Owners: Easy to install EPROM makes tuning in signals simple with an SSB/CW slow tuning rate of 2kHz. Faster turning gives faster tuning rate. $25 Giehl Electronics, PO Box 18335, Cincinnati OH 45218. BNB655

APPLE Owners Keep track of your DX contacts. This program files, sorts, alphabetizes and counts your DX contacts for each band. Need disk drive. $22. Scott Newpower, 673 Parkview Ave., St. Paul MN 55117. BNB657

Communications Receivers: The Vacuum Tube Era. Book covers history, specs on 700 receivers, 51 companies, 112 photos. $14.95 plus $2 P/S. Details SASE. RSM Communications, Dept 73, Box 218, Norwood MA 02062. BNB658

Commodore C-128 Radio/Electronics and Engineering Design software. Not available through any other source. Over 65 Design Programs. User Friendly Send $20 for 2 disks or SASE for information to Tri-County Amateur Radio Club, c/o KA4ZAY, P.O. Box 680741, Miami FL 33168-0741. BNB659

TEN-TEC ARGONAUT WANTED State s/n, condition, accessories. Rod Sharp N5NM, Box 2169, Santa Fe NM 87504; 505-988-2305. BNB660

ATLAS 350-XL WANTED State s/n, condition, accessories. Rod Sharp N5NM, Box 2169, Santa Fe NM 87504; 505-988-2305. BNB661

Brownies QSLs since 1939. Catalog and samples $1. (refundable with order) 3035 Lehigh Street, Allentown PA 18103. BNB662

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Number 25 on your Feedback card

PROPAGATION

Jim Gray W1XU

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7A	14	14	14	14
ARGENTINA	21	14	14	7A	7	7	7A	14	14A	21A	21A	21
AUSTRALIA	21	14	7A	7B	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	14	14	7A	7	7	7	7A	14	14	14	21	21
ENGLAND	14	7A	7	7	7	7A	14	14	14	14A	14A	14A
HAWAII	21	14	14A	7	7	7	7	7	14	14	14	21
INDIA	14	14	7B	7B	7B	7B	7A	14	14	14	14	14
JAPAN	14	14	14B	7B	7B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7A	7	7	7	7	14	14	14	14A	14
PHILIPPINES	14	14	14B	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14	14	7A	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	14	14	14	14A	14A	14	14
U.S.S.R.	7A	7	7	7	7	7B	14	14	14A	14A	14	14
WEST COAST	14A	14A	14	7	7	7	7	14	14	14	14A	14A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	14A	14	7A	7	7	7A	14	14A	21A	21A	21
AUSTRALIA	21	14	7A	7B	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	21	14	7A	7	7	7	7A	14	14	14A	21A	21
ENGLAND	14	7A	7	7	7	7	7A	14	14	14	14A	14
HAWAII	21	14	14A	7	7	7	7	7	14	14	14	21
INDIA	14	14	7A	7B	7B	7B	7B	7A	14	14	14	14
JAPAN	14	14	14	7B	7B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	7B	14	14	14	14A	14	14
U.S.S.R.	7A	7	7	7	7	7B	14B	14	14A	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7	7	7	14	21	21A	21A	21
AUSTRALIA	21A	14A	14	14	7A	7A	7	7	7	7B	14	21
CANAL ZONE	21	14	7A	7	7	7	7A	14	14	14	21A	21
ENGLAND	14	7A	7	7	7	7	7B	7A	14	14	14	14
HAWAII	21A	14A	14	14	7A	7	7	7	14	14	21	21
INDIA	14	14	14	7A	7B	7B	7B	7A	14	14	14	14
JAPAN	14A	14A	14	14	14B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7A	7	7	7	7	14	14	14	14A	14A
PHILIPPINES	14A	14	14	14	14B	7B	7B	14B	14	14	14	14
PUERTO RICO	14A	14	7A	7	7	7	7	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	7B	7B	14	14	14A	14	14
U.S.S.R.	7B	7B	7	7	7	7	7B	14B	14	14	14	14
EAST COAST	14A	14A	14	7	7	7	7	14	14	14	14A	14A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
# = Chance of aurora.
NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

Solar flux has increased from the low levels of 1985-86 to moderate levels in 1986-87. With this upward trend, greatly improved DX is likely on the 10- and 15-meter bands this year. January is not starting with a very promising first week or ten days, when HF propagation is likely to vary from good to poor. Beginning about the 10th, conditions are likely to improve and hold good until about the 17th. From the 19th or 20th through about the 27th, expect some geomagnetic upsets, up to storm levels at times, during this period. Although HF may well range to very poor, outstanding VHF and UHF openings are possible during this period. Expect the full effect on the 22nd, 23rd, and 24th. Fair conditions on the HF bands should return for the last five or six days of the month. Follow the charts for the general outlook, but tune in WWV for their hourly propagation reports, and listen to the ARRL propagation bulletins for late-breaking events. As always, keep tuned for other possible geophysical effects to accompany magnetic storm levels.

JANUARY

SUN	MON	TUE	WED	THU	FRI	SAT
					1 F–P	2 P
3 P–F	4 F	5 F	6 F–P	7 P	8 P–F	9 F–G
10 G	11 G	12 G	13 G	14 G	15 G–F	16 F
17 G	18 G	19 F	20 F–P	21 U	22 U	23 U
24 U / 31 G	25 P	26 F	27 F–G	28 F	29 F	30 F–G

BARTER 'N' BUY

from page 67

ATV

Number 26 on your Feedback card

Ham Television

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

GREETINGS AND HAPPY NEW YEAR

Hopefully 1988 will be as good a year for the ATV modes as last year was. '87 was highlighted by some good DX openings; the flight of a helium-filled balloon carrying ATV (WB8ELK); progress on building ATV repeaters and remote transmitters; the release of the new North American Repeater Directory; new international SSTV nets; developments in FAX; a new awareness of picking up video TV signals from foreign satellites; a lot of public service projects using FSTV; and better organization and recognition by ATVers through the USATVS organization. New gear is also on the marketplace and the popularity of FM-TV mode interest grew steadily.

What do we have to look forward to with Ham-TV in 1988? More discussions about a Fast Scan Television "Space Shuttle" or "Space Station" project will be held between ARRL, AMSAT, NASA (JSC ARC) and the USATVS. The Spec-Com Journal covered in detail a proposal by N9AB of Ivanhoe IL in the Sept/Oct and November issues (Volume 17, Nos. 8 and 9). The study proposal was incomplete with questionable calculations and assumptions. We need to hear from the ATV community with ideas and proposals on an "ATV in Space" project. Please direct your thoughts to: USATVS organization, through my address or via Bruce Brown WA9GVK/4 at 5597 Seminary Road, 2214-S, Falls Church VA 22041. As NASA's Space/SSTVer Astronaut Dr. Tony England W0ORE said at the September Fall Peoria Superfest and ATV Conference: "It needs a champion"! ATVers need to submit ideas and proposals through the League and/or the USATVS.

Back issues of the two Spec-Com issues and complete copy of the uncopyrighted N9AB proposal are available from the Membership Services Dept. at the USATVS (PO Box H, Lowden IA 52255). Send $5 to cover cost of the issues, copying charges and mailing. A special videotape addendum is available from Henry B. Ruth KB9FO in Des Plaines IL.

Videotape Exchange

Speaking of videotapes, we started an exciting new Ham-TV videocassette Pen-Pal project back in December called "Hello From America!". The December issue of Spec-Com gives details of a contest-type home videotape submission entry of no longer than 5 minutes per person to say "hello" and "show the shack" to foreign ATVers in the European ATV Working Group! Send a SASE for more details. I have worked with several foreign ATV groups in England, Scotland, Germany, New Zealand, Japan, and Australia on swapping VHS VCR tapes. Dr. John Fox WB2LLB/4 has been reconverting these invaluable productions from French SECAM or English PAL to good ol' American NTSC. We have established quite a library of exchanges. It is really lots of fun to "Pen-Pal" (CAM-Pal?) information about one another via a VCR. You don't even have to be on ATV to enjoy such exchanges! The received tapes are then duped and forwarded and played by many ATV groups either via simplex or on repeater systems for all to watch!

Remote-Controlled Air-Mobile ATV!

The AAAS ATV Club in Arizona sent us some nifty pictures of their large remote-controlled model airplane that carried a Sony B/W camera under the belly of the aircraft and a horizontally-polarized, omni-directional "egg-beater"-type antenna that was mounted on top of the cabin of the vehicle. It transmitted live TV pictures from the airplane while in flight and the results were videotaped on the ground. This all took place and was shown at the fall S.W. ARRL Convention in Scottsdale. A complete write-up with several photos is in the December '87 issue of Spec-Com. Way to go AAAS!

We also welcome the new appointment of Dwight Johnson WA7TSD as the new Arizona USATVS State Section Manager. He replaces the faithful reporting service of Bill Munsil N7AOU.

PATC Chicago ATV Repeater Project

Good news from Chicago! The ATV Repeater project, sponsored by Henry Ruh KB9FO and the Peacock ATV Club, is back on again after an NBC network strike halted access to further construction and testing of key transmitter and receiver sites within the Windy City. The strike broke down toward the end of October. Unfortunately, NBC will possibly lay off some 500 network positions in 1988, and it appears that GE is cutting things bare to the bone. Work continues both at the Merchandise Mart (Henry has been granted access privileges) and at the Hancock building as a possible transmitter site. New 10-GHz link equipment has been donated, and the PATC now has 14 paid-up members. All 14 have been given access rights to the already on-line ATV Weather Radar Remote Transmitter. The USATVS recently sent Henry a frequency coordination approval from a very-slow-to-act Illinois UHF frequency coordinator. The USATVS is a recognized frequency coordinator for ATVers and has been petitioning the ARRL and the FCC to take action against frequency coordinators who have conflict of interests or who refuse to honor the League's band plans, which they are supposed to be protecting. So far there has been little response from the League.

Keep up the good work Henry and crew!

Uncoordinated Coordinators?

A strange new radar-type pulse is invading the Washington, DC, area Fast-Scan band around 439.25 MHz. Interference problems such as this must be reported to the FCC and in the Washington, DC, case, investigators are now on the scene. Poor frequency coordination, resulting in even more QRM to ATVers is also a growing threat to ATVers and other mode users on UHF, especially on the 70-cm band. One such example is Chicago, where the frequency coordinator for UHF in Illinois is said to have admitted to over 60 repeater links or hidden (unpublished) operator usages placed on the lower 421-MHz part of the band where an ATV repeater output is supposed to operate. These placements violate even the ARRL band plan. When I wrote to David Sumner of the League about the problem, the only reply that came back was that the League can not do anything on this matter since they do not control or sponsor it. My question then is: "Who coordinates the coordinators?"

Some states are joining a larger council, which will hopefully resolve some of these issues. Other states have no such oversight authority. If a frequency coordinator goes astray, who removes or corrects them? No one, not even the FCC, seems to want to act on this question. Pressure must be brought to the League on this matter so that, in time, and with enough complaints, someone is bound to have to answer to someone else. There must be a system of checks and balances to function properly. It's basic government and very good business sense.

It is vitally important for all ATVers to log and report known interference problems. Report it to the League and the USATVS. The USATVS continues to work with these coordinators in getting the message across that ATVers have rights, too, and will speak up

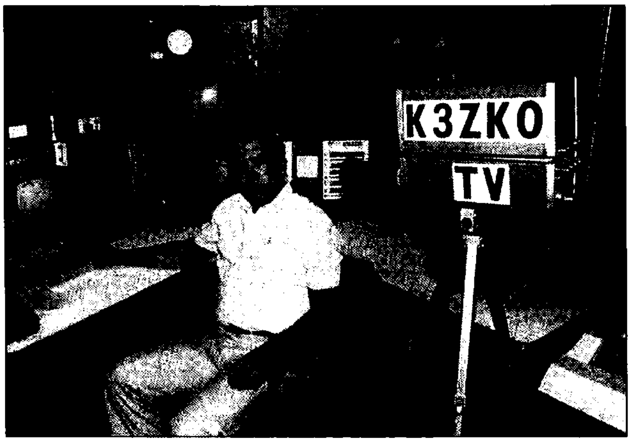


Photo A. Ron Cohen K3ZKO and his superb ATV shack.

when they are violated! ATVers must be represented at all VUAC and other committee meetings when discussing or deciding any frequency matter that may affect FSTV operations. To date, this just hasn't happened very much except for a few SSB, AMSAT and packet operators who claim to be ATVers as well. Things are changing and ATVers are finally getting better organized!

WB8ELK Balloon Recovered

Bill Brown WB8ELK reports that the helium-filled balloon, carrying ATV and 2-meter gear, that was launched and flew to 100,000 feet last August, has been recovered! An area farmer about 30 miles from the Findlay OH launch site, was harvesting his cornfield when he noticed a white styrofoam package and buried balloon near his harvester. The return address allowed the farmer to contact Bill and crew and, at last, "all was saved!" All gear checked out in operating condition.

What is next on the agenda for Crazy Bill and gang? An "across-the-country flight" leading to an eventual "around-the-world" balloon flight to carry ATV and radio communications, says Bill! Planning is already underway for a California-to-Eastern Midwest excursion sometime in 1988.

75-Meter ATV Net

Check out WB8ELK's plans and details of next upcoming flight or get in on any of the regular FSTV discussions on the weekly Tuesday night 10 PM (EST) ATV "Talk and DX Coordination" net held near 3.865 MHz. More and more ATVers are joining and using the 3.865 MHz frequency in the late evenings and early mornings to take advantage of DX openings and just to keep in touch with one another on what's happening in the world of Ham-TV! Drop by some Tuesday and join us!

Photo of the Month

This month's best ATV Shack Photo goes to Ron Cohen K3ZKO of the Philadelphia ATV Group. The photo shows a mixture of old and new equipment, most of which Ron built up himself. Ron has been a pioneer on ATV for over 20 years and is a former editor of A5-ATV Magazine.

See ya' next month, Ham-TV fans! Keep those cards and letters coming. de WB0QCD

Look North!

Canadian and Soviet Hams Trekking Across the Arctic

by Larry Ledlow, Jr. NA5E

The low HF bands should liven up with arctic DX beginning in February. Canadian and Soviet scientists will participate in an historic, transpolar ski trek between Severnaya Zemlya archipelago and Cape Columbia on Ellesmere Island. Amateur radio wi'l support the expedition, which will take more than three months and cover more than 2000 kilometers across the polar ice cap. Further, the Department of Communications has announced third party traffic and reciprocal operating agreements between Canada and the USSR between 1 November 1987 and the conclusion of the expedition (see QRX)!

Although the eight trekkers will carry out a number of scientific experiments, this is an excellent opportunity to demonstrate the reliability and utility of amateur radio communications. Dr. Dmitry Shparo UA3AJH, chief of the expedition, and Leonid Labutin UA3CR are two Soviet hams taking part in the journey. Both are well known and highly respected operators in the Soviet Union. The Canadian trekking hams had not been named at press time. Four team members from each country were to be chosen after exhaustive training exercises in the Tien Shan mountains of the USSR and near Frobisher Bay, Northwest Territories, during last fall.

CRRL president Tom Atkins VE3CDM is coordinating Canadian participation in the event. Canadian hams across the country will support the expedition by relaying traffic and scientific data from the ski team. Two communications bases will be established at Resolute and Frobisher Bay, NWT. Al d'Eon VE3AND, Tony Fegan VE3QF, Barry Garrett VE3CDX/CE8CDX, Gary Hammond VE3XN, Ron Belleville VE3AUM, Terry Keim VE8TF, Ron Lupack VE8AZ, and Larry Horlick VE8HL will man the bases on a rotating schedule for the duration of the trek.

Each day the team will communicate for approximately one hour with the communications bases, probably on 40 or 80 meters. The low bands tend to be more reliable for arctic communications. The skiers will carry equipment for MF, HF, and VHF communications. In addition, two search and rescue satellite (SARSAT) transmitters will be used. One SARSAT transmitter will allow the team to take daily position fixes, and the other will remain in reserve for emergencies.

Six air drops will provide fuel, equipment and other supplies to the team. The team will rest for several days at the air drop points and also carry out the main scientific experiments.

The expedition organizers wish to avoid any political association, in the interest of true international cooperation. As a result, the ski trek requires a great deal of private funding. Those interested in financially assisting this historic endeavor should contact the Polar Bridge Fund at Box 313, Don Mills, Ontario M3C 2S7.

Number 28 on your Feedback card

Dx

Hams Around the World

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

ON THE AIR FROM LIBYA

Amateur activity trom Libya has been very scarce over the past dozen years, with one exception. In late 1986 and early 1987, Hebert Trzaska SP6RT made more than 35,000 contacts from this North African spot. His story is an inspiring example of the resourcefulness and dedication of an active DXer, and well reflects the true spirit ol furthering international goodwill through DX.

First Steps

Bert arrived in Libya in the fall of 1985, as guest of the Socialist People's Libyan Arab Jamahirija (SPLAJ), to teach in the electrical engineering department of recently erected Garyounis University, in Benghazi. Bert's first act there was to apply for permission to operate amateur radio equipment. He reasoned that this was a necessary part of his research into electromagnetic susceptibility (TVI and RFI) and propagation research.

Fully nine months and many inquiries later, Bert's amateur permission came through. Unfortunately, he couldn't bring in any radio gear at that time, nor get his own gear shipped from Poland. Imagine the frustration of a DXer in Libya with a license but no gear!

Typical ham resourcefulness came into action. Bert searched through the lab equipment at the university and found an excellent Rohde-Schwartz EK-070 receiver that would cover the amateur bands. The search for the transmitter was more difficult. He turned to various amateur radio and DX foundations for assistance, but most wanted assurance that the operation would count for DXCC before providing gear. Bert finally located a transmitter of sorts.

Getting on the Air

The university's lab included a Wavetek 178 signal generator that could pump out as much as 1 Watt, under ideal conditions. Bert was able to squeeze only a third of a Watt out of the generator, however, with his jury-rigged antenna. He increased this slightly by feeding the antenna through an attenuator. The better impedance match of the attenuator more than compensated for the 3-dB attenuation, and he was on the air with a half-watt into the antenna!

The arrangement was far from perfect. The antenna was hard to tune and his operation position was surrounded by high-power broadcast transmitters, which swamped available impedance-measuring devices. Keying the rig was yet another problem. Since it took too long to reach a stable frequency, Bert decided to key the antenna circuit instead of keying the frequency generator directly. Bert resorted to tapping a banana plug into a socket to key his signal. While continuing to scrounge for parts to build a simple amplifier or even a matching network, Bert fired up this improvised station as 5AØA on 14005 kHz on November 22, 1986, and logged G6ZO for his first QSO.

QRP Operation

Over the next three months, Bert logged nearly 6,000 contacts on every continent in more than 60 different countries. The first 2,000 QSOs were made with his makeshift "keyer." Small wonder The DX Bulletin reported at the time that Bert's CW was "very slow, and often strange!"

Gradually the amateur community began to help out. DJ2BW and DK1RV sent an electronic keyer to Bert at the end of January, and Bert's QSO rate doubled. Then, following the ARRL's acceptance of Bert's 5AØA operation for DXCC credit, the fledgling European DX Foundation chipped in a Yaesu FT-901D transceiver. Lack of rotor and cables, and difficulties with customs, however, foiled an attempt to erect a tribander donated by the INDEXA. Bert continued to use dipoles about 20 feet high for the rest of his operation.

Observations on the Bands

Bert had little trouble working Europe with his modest station. Almost 29,000 of his 35,000 QSOs were with European DXers. He worked 3,700 North American hams, and 2,300 Asians, but only a handful of Oceania, South American, and fellow African amateurs.

Bert made a particular effort to work as many stations as possible, but had to struggle through much QRM. He compares the pileups with the queues in meat shops in his native Poland. But he hung in there, and maintained an iron fist on the pileups. Bert kept control of the frequency by answering questions only when asked during a QSO, not answering obvious questions (What country is 5A?), and not accepting many skeds from other bands.

The usual DX "policemen" harassed his operation, particularly because his QSL manager, SP6BZ, was not listed in the latest Callbook. He avoided list operations with the single exception of Jim Smith VK9NS's net, which he used to work South Pacific stations.

Nearly Problem Free

His only real operating problem came from DXers seeking insurance contacts through duplicated QSOs on the same band and mode. Each such insurance contact reduced his chances of giving out Libya as a New One. Some DXers called more than 10 times, and soon found themselves on Bert's black list. "They'll find their wait for a 5AØA QSL to be a long one!" Bert says, "Fortunately the list contains very few call signs. Unfortunately, the majority of them are well-known DX-men."

Bert's operating schedule varied from day to day, but he spent much of his free time on the air, perched on his hard lab stool in front of the rig. Sometimes teaching pulled him away during prime propagation, but his job took precedence over the radio activities. Still, he was successful at working enough stations that he could occasionally call CQ and get no response. He took these opportunities to try some other bands, and work some SSB as

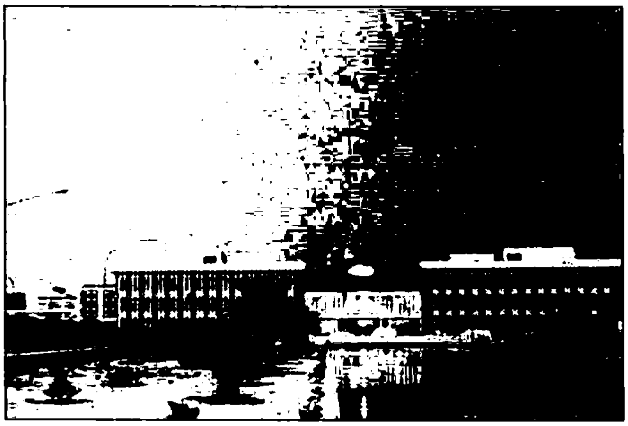


Photo A. Garyounis University in Benghazi, Libya, site of 5AØA.

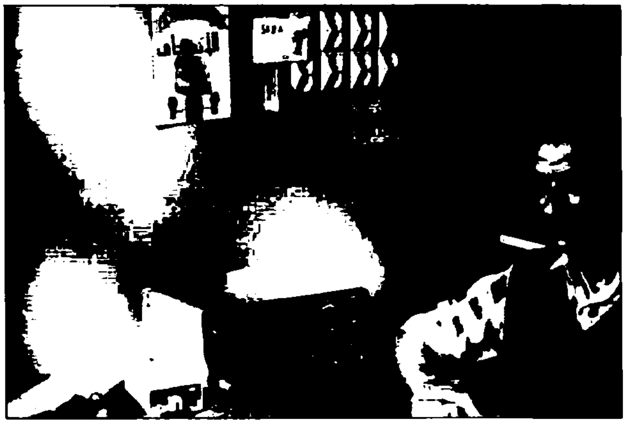


Photo B. Bert Trzaska SP6RT operating 5AØA.

He even managed a few dozen QSOs on 60 meters before a rig problem forced him off his band.

well as CW. He even managed a few dozen QSOs on 160 meters, before a rig problem forced him off the band.

Bert wrapped up his 5A0A operation on July 1, 1987, after logging 35,569 QSOs in 167 countries. He expresses his thanks to those who provided invaluable assistance, including DJ2BW and DK1RV for the keyer, DK9KD and the European DX Foundation for the rig, the SPLAJ authorities for operating permission, and his co-workers and friends at Garyounis University for their support.

	80 CW	80 SSB	40 CW	40 SSB	20 CW	20 SSB	15 CW	15 SSB	10 CW	10 SSB	Totals
Eu	562	60	3944	370	8146	2001	7947	4256	1354	86	28726
Af	1		5		24	35	36	87	12	4	204
As	8		460	4	714	61	940	98	18	2	2305
NA	82		323	1	2261	335	279	398	10	1	3690
SA	2		22		29	27	127	171	44	6	428
Oc			5	5	49	101	26	27	3		216
Tot.	655	60	4759	380	11223	2560	9355	5037	1441	99	35569
%DX	14		17	3	27	22	15	16	6	13	19.24
USA	80		313		2104	288	211	353	10	1	3.360

(The European CW contacts listed in the 80m column include 160m contacts.)

Number 30 on your Feedback card

PACKET TALK

Latest in Digital Hamming

Brian Lloyd WB6RQN
19200 Tilford Way
Germantown MD 20874

THE MURKY WORLD OF PROTOCOLS

Packet radio is getting ready to go through a major change. Many people involved with the development have discovered that AX.25 Level 2 is not capable of supporting the growth, and we now need some sort of Layer 3, or networking, protocol. I have received a number of requests asking for a better explanation of what is going on in this area. This is the first in an ongoing series on networks and how they relate to your packet radio station.

In order to facilitate discussion of networks, the International Standards Organization (ISO) came out with a recommendation for the description of networks. This became known as the reference model of Open System Interconnection (OSI) or the "seven-layer network" model. Let's quickly go through the layers and their general meanings.

Layer Definitions

The PHYSICAL layer (layer 1) does those things having to do with the physical data transport. Items such as modems, cables, data rates, and interface specifications all fall into this layer.

The LINK layer (layer 2) embodies whatever protocols and techniques are necessary to deliver packets from one point to another within the network, often in an error-free fashion.

The NETWORK layer (layer 3) handles the routing of packets from their original source to the final destination.

The TRANSPORT layer (layer 4) ensures the proper end-to-end delivery of packets from source to destination.

The SESSION layer (layer 5) is responsible for keeping the packets from one session separate from those of another. For example the SESSION layer would ensure that my file transfer does not get mixed up with my keyboard QSO even though they are going from the same source to the same destination.

The PRESENTATION layer (layer 6) handles generic operations such as ASCII to Baudot conversions and data encryption.

The APPLICATION layer (layer 7) provides a way for programs and users to access the network in an orderly fashion.

ISO Model and Current Packet Radio

For most of us in packet radio, the physical layer means an narrow bandwidth FM signal in the 2-m band with a peak deviation of 3 kHz modulated with an AFSK signal using 1200- and 2400-Hz tones. The bit stream is encoded using Non-Return Zero Invert (NRZI) and sent at the rate of 1200 bps.

The link layer is the High-level Data Link Control (HDLC) frame format with its built-in error detection in the form of a Cyclical Redundancy Check (CRC). The link protocol is very simple. If the CRC shows that a packet is in error, the packet is discarded. Note that while this ensures that bad data won't get delivered to the destination, it does not ensure that good data will get delivered.

The network layer is our digipeater specification. When you establish a connection, you must tell the TNC the precise route to use to get to the destination. This is called strict- source routing.

The transport service is provided by AX.25 Level 2. If a packet is lost somewhere between the source and destination the transport service (AX.25) will cause that packet to be resent. Notice that the transport service will ensure receipt of packets end-to-end and it is not absolutely necessary that the link layer ensure delivery of data.

The session layer is rather nebulous, but someone could make an argument that the stream switch is used to keep sessions with multiple stations separate and could therefore be considered by some to be a form of session protocol. The presentation layer is again rather difficult to locate in our TNCs, but I guess that we could consider the TNC commands FILTER, LFADD, and LCOK to be a form of translation.

The application layer is represented by TNC's command processor and the interface to your terminal.

Questions about AX.25

Ok, ok, I can hear the screams of protest already. I know what many of you are going to say: AX.25 is really only a link-layer protocol and that the addition of a "layer 3" atop our existing AX.25 "layer 2" protocol is, in fact, what all this networking hoo-rah is about. I agree that AX.25 is supposed to be only a "layer 2" protocol, but that is not how it is used now. AX.25 makes sure that the packets are delivered from end-point to end-point and therefore qualifies as a transport protocol. Someone once said to me, "If it looks like a duck, quacks like a duck, and swims like a duck, then it is probably a duck."

> *"AX.25 is supposed to be only a layer-2 protocol."*

Let's dig a little further into some of the complaints that are surfacing. First, as Tom Clark W3IWI pointed out a while back in his famous, "But wait, there's more," article, trying to push packets through more than about two digipeaters is a fruitless activity. Besides, the eight-digipeater limit and being required to specify the entire route is also annoying and very limiting. So the real complaint is that most of you do not like the existing link, network, and transport protocols and would like to relegate AX.25 to the job of being a link protocol, a job it was originally designed to do. OK, I'll buy that. But, if you do that, you need a new networking and transport protocol. Therein lies the furor—how to best accomplish this task.

Datagrams and Virtual Circuits

In order to go much further, you need to understand some other concepts. A major debate to date has raged on the differences between a datagram-based network and a virtual-circuit network. These differences have a great deal to do with how the network and transport protocols do their jobs.

Datagram and virtual circuit (VC) networks may work in a similar fashion or they may be very different. The definition of a datagram network is that every packet contains the full source and destination addresses (that means that our existing implementation of AX.25 is a datagram-based network and transport protocol with strict-source routing). This allows the network the option of routing each packet independently.

The analogy used most often is that of the post office. You take your file or message, break it up into packets (letters), and transmit (mail) each one separately. By virtue of this technique there is no guarantee that the network (post office) will keep the packets (letters) in the same order so that it becomes the job of the transport service (the recipient of the mail) to reassemble them into the proper order. As a consequence the transport layer does more of the work allowing the network layer to be simpler.

On the other hand we can construct a VC network and use the analogy of the phone system. An exchange begins with a call request packet (dial the call) traveling through the network. At each node in the network that particular "call" is assigned a Logical Channel Identifier (LCI). From then on each packet contains the LCI rather than the address and every packet takes the same route through the network much like you are assigned a channel from the beginning of a phone call until you hang up again (or are disconnected). As a result of this a VC network tends to have a more complex network layer and a simpler transport layer.

Both approaches have their plusses and minuses. There are two advantages of a VC-based network:

- It switches packets faster because it doesn't have to look up the route for each packet. That's done at the time of the call-request packet.
- The full address isn't needed in every packet so header overhead is less.

Datagrams also offer two advantages:

- If a switch should fail other switches can easily bypass the failed switch and keep the packets moving. Any packets lost when the switch failed are retransmitted by the source transport service when the loss is finally detected.
- Each packet is treated separately so a switch does not need to "remember" anything about the

past (no "channels"). Most of the memory in the switch can be used for buffering without concern for where packets come from or where they are going.

Thus, the key difference between the two approaches is that a virtual circuit switch can support only a limited number of connections and will "disconnect" all connections passing through it if it fails. In the commercial world where extremely reliable hardware is the rule, this usually is not a problem. On the other hand, a datagram network handles changes in and damage to the network much better than a VC network.

Packet Networks Today

Currently there are three networking packages in amateur packet radio, all based on datagrams. These three networking packages are NET/ROM, TEXNET, and NET.EXE. A fourth, COSI, was announced about a year ago but has not been released. It uses virtual circuits and is based on some of the ISO and CCITT protocol recommendations. I will talk about it in another column when the software is finally available.

NET/ROM is available in the form of a replacement ROM for the TNC-2s and is intended to essentially replace digipeaters. TEXNET is a set of software that runs on a special piece of hardware called a Node Control Processor (NCP) designed by the members of the Texas Packet Radio Society. NET.EXE is an implementation of the international standard Internet Protocol Suite (TCP/IP) and runs on PC clones, the Commodore Amiga, the Apple MacIntosh, and most small UNIX systems.

Which one of these packages or approaches is best? The answer is simple: it depends upon your application and interest. Before you decide which networking package is best, you need to decide what services you want the network to provide.

NET/ROM

To date all amateur packet operations have been based on the concept of a user sitting at a terminal conversing with another user or with a BBS. The other concept is that of a computer conversing with another computer. If you are satisfied with rag-chewing and using the local BBS then very little needs to be changed. In that case, NET/ROM will probably appeal most to you since it is by far the simplest change to our existing network.

NET/ROM nodes connect to each other using AX.25 and then converse with each other using their own internal protocol. You use a NET/ROM network by connecting to your local NET/ROM node, telling it to connect to the NET/ROM node closest to the destination, and then telling that NET/ROM node to connect to the destination (three connect commands are always required). In this manner NET/ROM replaces the digipeaters and removes the requirement for strict-source routing. However, you still need to know where your local NET/ROM node is and what NET/ROM node is nearest your destination.

"Any TNC-2 can be turned into a NET/ROM node."

Internally, NET/ROM uses datagrams. The NET/ROMs share information about what other NET/ROMs are in the network. Each NET/ROM maintains a list of all the other nodes in the network and will attempt to route packets around a failed node should the need arise.

There is no concept of a logical connection except at the edges of the network where the end-user TNCs connect. NET/ROM has a transport (layer 4) protocol that provides reliable service up to the point where users' TNCs connect and therefore is not a true transport protocol. A true transport protocol is end-to-end. Perhaps what NET/ROM has can be called an edge-to-edge protocol, meaning it provides reliable service to the edge of the network where the user connects.

Any TNC-2 can be turned into a NET/ROM node. All you need to do is remove the old TNC program ROM and insert a new ROM from Software 2000. Once this is done the TNC is no longer useful as an end-user TNC—it becomes a packet switch only.

For NET/ROM to work well you must have two or more TNCs and an appropriate number of NET/ROMs (extra ROMs used in this manner are available at a lower price). The TNCs are connected together at the asynchronous (terminal) ports. This provides the potential for multi-frequency packet switching, a must for efficient operation. (Next month I will discuss why repeating packets on the same frequency is a no-no and why simplex digipeaters should be abolished).

TEXNET

This package comes next in the area of interest and services. TEXNET is also a datagram service but it has no end-to-end or edge-to-edge transport-like protocol. For keyboard-type operation this is not a real problem because the user can act as a transport protocol and restart a session should he/she become disconnected. TEXNET becomes really interesting when you discover that it is providing services such as the network BBS, the conference bridge (round-table type of operation), and the weather-service interface. Finally something more than the venerable BBS!

As far as I can tell, the major drawback to TEXNET (if it has one) is that it runs only on a special Node Control Processor (NCP) designed by the Texas Packet Radio Society. I have no idea how available it is, but I surmise that it is not as easy to get as a TNC-2 or a PC clone.

NET.EXE

The last networking package I will discuss this month is NET.EXE written by Phil Karn KA9Q. Unlike the other two packages, it makes a fairly radical break from traditional packet in that it does not make an attempt to use a standard TNC for the user interface. Instead it requires a more powerful personal computer such as a PC clone. It uses the international standard Internet Protocol Suite otherwise known as TCP/IP (named for the most significant protocols in the suite, the Transmission Control Protocol and the Internet Protocol). IP is the network layer and is a true datagram protocol. TCP is the transport service that handles the end-to-end request for retransmission of lost packets and resequences out-of-sequence packets. The result is a network that looks like a VC to the user or application but has the advantages of a datagram network.

NET.EXE doesn't just stop there either. It provides three applications: the File Transfer Protocol or FTP, the Simple Mail Transfer Protocol or SMTP, and a terminal-to-terminal and terminal-to-host protocol called TELNET. In addition to providing these services, NET.EXE is fully multi-user and will support multiple FTP, TELNET, and SMTP sessions concurrently. The distribution of NET.EXE comes with full technical documentation and source code so that you can make your own changes and enhancements.

In Conclusion

Aren't these protocols mutually exclusive? If you choose one do you have to forego the advantages of the others? Not necessarily. However, this leads us into the realm of internet working (interconnecting two or more dissimilar networks), a subject I will discuss in detail in a subsequent column. I will give you a hint though: notice that the network protocol in TCP/IP is called the Internet Protocol.

That's it for this month. Next month I will be talking about improvements to the physical layer: modems, radios, and channel access techniques. See you then!

For further information on the protocols discussed in this column:

NET/ROM: Software 2000, Inc.
1127 Hetrick Avenue
Arroyo Grande CA 93420
(804) 489-1977

TEXNET: Texas Packet Radio Society, Inc.
PO Box 831566
Richardson TX 75083

NET.EXE: Tucson Amateur Packet Radio Corp.
PO Box 22888
Tucson AZ 85734

WEATHERSATS

View On Video Processing

Dr. Ralph E. Taggart WB8DQT
602 S. Jefferson
Mason MI 48854

IMAGE PROCESSING

Last month I began a discussion of image processing techniques, which I continue with here. Prior to doing that, however, I want to diverge just slightly to discuss some aspects of tape systems since taped signals will be a primary image source for many approaches to video processing.

The Audio Tape Dilemma

Whenever we engage in significant contrast enhancement, we are taking a small range of signal amplitude variations and converting them to a wider range of output variations. When we do this, the quality of the signal becomes quite critical. Subcarrier level variations, noise, or other signal anomalies that might be barely visible in a linear display can become quite objectionable when we expand the contrast of the display. If we take 25% of the subcarrier dynamic range and expand it to the full dynamic range of the display system, we essentially expand contrast by a factor of 4. Any unwanted amplitude shifts in the signal will be expanded to the same degree! Proper upkeep and servicing of the tape system is of primary importance if you really want to manipulate the image data.

Analog Processing

In this age of digital marvels, it may seem strange to suggest that anything useful can be accomplished using analog processing, but it is surprising what some fairly simple techniques can do. An example of this has already been alluded to with regard to expanding the contrast of visible light data. In all of the Weather Satellite Handbook (WSH) circuits, including the scan converter, the output of the video detector is clipped to a maximum of approximately +5V by a zener diode at the output of the post-detection filter. In effect, no matter how hard you drive the video contrast, white level cannot exceed this limit. This is what makes it possible to adjust the video drive to whatever is required to get good visible light contrast without, at the same time, over-driving the display system with IR signal levels.

Although simple approaches work well for visible data, solving the IR problem is more complex. An interesting approach was taken by Bayless in the design of a contrast expansion processor for NOAA IR data which appeared in Wireless World about ten years back. He used DC-biased diode networks to pass both the positive- and negative-going halves of the 2400-Hz subcarrier signal in a manner that essentially clips the signal to permit the upper part of the dynamic range to be expanded to full contrast.

In essence, the circuit is an audio clipper that will only pass subcarrier peaks that exceed a preset level. The result is any degree of expansion of the contrast at the white end of the grayscale with all video values below the threshold converted to black. Because of the way the circuit works, there is essentially no subcarrier signal at all in these "black gaps," so if you are using subcarrier lock for timing, you had better rewire your system to lock to a subcarrier signal ahead of the processor to avoid a loss of lock during much of a typical visible light line. The circuit is fairly simple, but an oscilloscope is a necessity because of the critical level adjustments. The main advantage of the circuit is that it slips between the video source (receiver, tape deck, etc.) and your unmodified display system.

Transparent Digital Processing

Analog circuits to perform more complicated processing tasks soon get very complicated and can be very elaborate to set up. In contrast, digital techniques are comparatively simple. Fundamental to any digital processing scheme is the conversion of analog data to digital (numerical) form, also known as A/D conversion. At this point, we can begin to modify the data by numerical or mathematical operations.

Although you might think that digital image techniques would be limited to a digital imaging system, we can perform a wide range of operations using what I refer to as "transparent" digital processing. In effect, we insert a digital processing "black box" between our signal source and our display system, whether digital or analog. Such an approach permits you to perform a wide range of image-enhancement experiments and procedures without altering your display system in any way.

One of the simplest ways to incorporate this digital "transparency" is shown in Figure 1. IC U1 performs an A/D conversion, followed by IC U3, which takes the digital output of U1 and performs a D/A conversion! Bear with me for a moment and all will become clear!

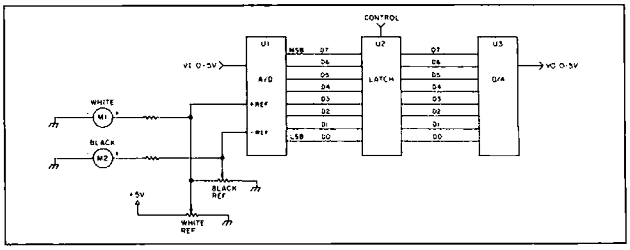


Fig. 1. Digital processing circuit. The BLACK and WHITE REF controls can be set to provide any degree of enhancement over any given segment of the input waveform.

U1 is a basic hardware A/D chip and a great many ICs could be used—an ADC-0804 is one inexpensive option. A 0–5V video signal (derived from your normal video detector/filter for example), is applied to the input and an 8-bit digital value (0–255) will appear on the 8 digital output lines, corresponding to the analog voltage level on the input. 8-bit video conversion, with 256 possible grayscale steps) is so close to analog in quality that it might as well be analog!

In this application the chip should be wired so that it is constantly making conversions, one after the other. A chip such as the ADC-0804 will complete a conversion in approximately 100 microseconds. The free-running chip will therefore complete approximately 2500 conversions in the course of a WEFAX line or the visible or IR segment of an APT line so there is no problem with limiting resolution! There are other gimmicks associated with the A/D chip but we will skip these for the moment. U2 is an octal latch that will hold the 8-bit output from U1 constant, updating the digital lines at the completion of each conversion.

The 8-bit digital value from U1 is converted back to analog by U3, a hardware 8-bit digital to analog (D/A) converter. Again, there are a wide variety of commercial chips that will do the job. Alternatively, a number of op-amp stages (summing amplifier plus gain/offset stages) could perform the same function. In effect, we go from a 0–5V analog signal at the input, through 8-bit digital, and back to 0–5V analog.

The Point

"So What?" you may say. Let's look, however, at two features of U1, the "+" and "-" reference inputs, which we have ignored up to this point. To perform the usual linear conversion, the "-" reference input would be held at ground and the "+" reference input would be wired to +5V. In that configuration, the 256 output steps would be evenly spaced between 0V and +5V. In effect, the output waveform would be a duplicate of the input signal and we would not even realize that the circuit was in place. In this circuit,

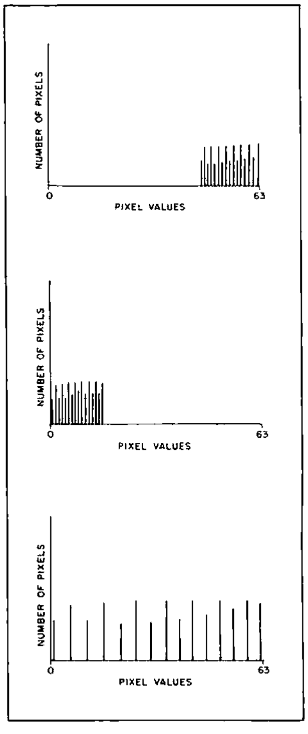


Fig. 1b. This shows the principle of "reassigning" pixel values from low contrast images to give improved displays.

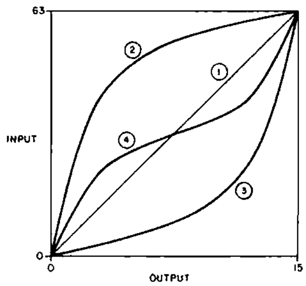


Fig. 2 Non-linear contrast curves. Details next month.

however, we have connected the reference inputs to two reference pots, allowing us to set the "+" and "-" reference values. Each reference input is connected to a voltmeter (M1 and M2). For the sake of obtaining the best possible resolution, these voltmeters could be 1-mA units, each with a series resistor to provide full-scale deflection at +5V. The use of 0–1.0 scales on the meters is convenient in that we use the meter readings as a percentage of the input waveform.

The use of these variable reference voltages is best illustrated by going back to Figure 1 of last month to tackle the rather extreme problem of the visible and IR data. Let's take the IR problem first. The basic IR problem was one of limited dynamic range, all of it concentrated at the high end, resulting in a white display with little or no detail. What we would like to do is to expand this small dynamic range to something approaching a full black-to-white "swing."

Suppose that we want to expand the contrast of the upper 25% of the video dynamic range. To accomplish this, the WHITE REF pot would be set for a reading of 1.0 (100%, or +5V) on M1 while the BLACK REF pot would be adjusted for a reading of 0.75 (75%, +3.75V) on M2. On this configuration, all of the 256 output steps will be within the range of 3.75 and 5.00 V. Any value below 3.75 will give a 0 output. In effect, the entire 0V to +5V output from U3 will represent video variations over the upper 25% of the video dynamic range. Assuming that we have not set our video gain so high that we have clipped the IR channel at +5V at the input, the result will be excellent contrast for the IR data.

If we wanted to enhance the contrast in the visible light channel we could take a similar approach. To expand the lower 25% of the video dynamic range, for example, we could set the WHITE REF pot for a reading of 0.25 while the BLACK REF pot would be set for a reading of 0. Now the full-range output represents the lower 25% of the video waveform, the result being excellent contrast in the visible channel data!

In effect, the BLACK and WHITE REF controls can be set to provide any degree of enhancement over any given segment of .he input waveform. Note that the way the controls are set up, the voltage set by the BLACK REF pot will always be less than that established by the WHITE REF control, which is as it should be! For a linear conversion, simply set the WHITE REF for 1.0 and the BLACK REF for 0, otherwise, the controls should be set for the desired black and white limits.

Extremely Versatile

This particular circuit can be used in a "stand-alone" mode by simply inserting it between the video detector/filter output and the remaining circuits in any display system. The circuit can be placed in its own cabinet with input and output jacks added to your existing display system. For a display system that uses something else other than a 0–5V video range, the system can be tailored to any other voltage range.

You can expand the utility of the system even further by putting a computer in the loop between U2 and U3. The computer can read values from U2, modify them, and feed another output value to U3. The computer can run in an "open loop" mode, simply making conversions as quickly as possible. Assuming reasonably compact assembly language code, most computers should not greatly diminish the inherent resolution of the system. The possibilities for conversion will be outlined in next month's treatment of digital enhancement techniques.

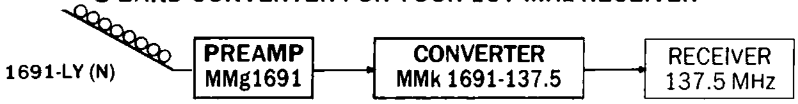
The "transparent digital" approach illustrated here is an optimum approach for existing analog display systems such as CRT monitors and FAX recorders in that you obtain some of the flexibility and ease of digital processing in the context of an analog system. This approach will also work well with dedicated digital scan converters, since it is rarely possible to alter the hard-wired aspects of such systems and alteration of the programming of microprocessor-based systems is a highly specialized undertaking. This is also true in the case of computer-based systems where you lack the skill (or the will!) to alter the system programming to incorporate new imaging options.

Next month we will examine some aspects of purely digital image processing.

Picture of the Month

This shows a bit of what can be accomplished with an outboard processor along the lines of this month's discussion. It represents a Smartfax print from the WSH scan converter of a winter NOAA visible light pass over the Great Lakes. With the scan converter contrast set for good WEFAX display, the visible light channel was extremely dark with just a bit of brightening on the cloud features. With the same contrast setting, running the signal through the external processor serves to bring out features that would not otherwise be visible without completely altering the scan converter contrast. 73

Photo A. Smartfax print of the Great Lakes (toward upper right).



RTTY LOOP

Number 32 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

DEFINITIVE CoCo RTTY

I've included listings here sure to gladden many a CoCoer's heart. Thanks to N6LQV, who prefers to be known only by his callsign, we have an updated version of the CoCo RTTY program published in my June '87 column.

This is an interfaceless program. It decodes audio directly presented through the cassette interface input, and puts out an audio tone frequency shifted in step with the RTTY being sent. The key difference between this program and the original version is the raft of features added.

To begin with, disk access is directly supported. The transmit buffer can be loaded from disk, and data saved into a receive buffer saved to disk. Although this program is limited to five-level Murray (Baudot) code, common speeds are supported, from 45 bauds (60 wpm) to 75 bauds (100 wpm).

This is not a disk-only program. This one is both disk and tape, and, because it appears to use BASIC calls to routines, should work well with most types of Disk ROMs. After the tape-only listing in June, and the disk-only one in July, I hope this squares the record with all the CoCo folks.

The Programs

Two programs are presented here. The first, is the BASIC language driver for the program. Type this in exactly as presented and save it on disk as "RTTY.BAS". Later, you will boot the program by typing RUN"RTTY. Remember to format the listings for these programs into 32-character lines to match the standard CoCo display.

The second program is a BASIC loader that creates the machine-language program, RTTY.BIN, which does the bulk of the work. Note that it is self-checking. If you make a typo while entering the program it will not run, but will tell you about it.

Save this program as MAKERTTY.BAS and RUN it, and it will create the required RTTY.BIN program for you. You may then discard or archive MAKERTTY.BAS.

There are a few options to keyboarding in these programs. Subscribers to Delphi can find the upload of the complete files for this program in the CoCo SIG's Data Communication database. This is courtesy of Marty Goodman, one of the SYSOPs of the Color Computer SIG. After logging onto Delphi, type GROUP COCO to go to the CoCo SIG, then select DATABASES, and DATA COMMUNICATION.

You can also take advantage of my usual deal. Send me two bucks, a blank tape or disk (no need to format the disk, by the way), and a stamped, self-addressed disk mailer. I will load these programs, a ready-to-run binary file, the source code for the binary file, and some written information, and ship/wire/hand the whole kit and caboodle back to you. My thanks to N6LQV and Marty Goodman for making this blockbuster of a program available to the readers of RTTY Loop.

How to Use the Program

As stated above, this is an "interfaceless" program. The receiver audio feeds directly into the CoCo using the plug that normally would go into the EAR jack on the cassette recorder (the black plug), and it sends AFSK via the cassette record output (the gray plug).

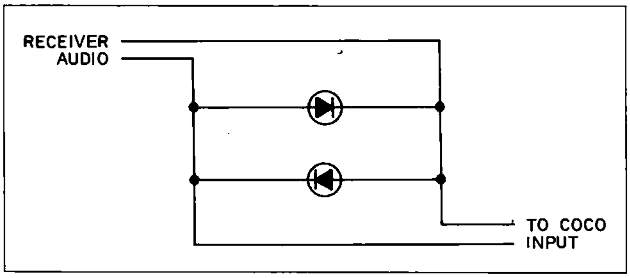


Figure 1. Schematic for a simple limiter.

RTTY.BAS Program

```
5 REM THIS PROGRAM IS PUBLIC DOMAIN, BY N6LQV
10 CLEAR 200,&H4000:C=3
20 D=(PEEK(&HC000)=68):REM TAPE:
D=0, DISK: D=-1
30 IF D THEN LOADM"RTTY" ELSE CL
OADM"RTTY"
40 DEFUSR0=&HE00:DEFUSR1=&HE03
50 DEFUSR2=&HE06:DEFUSR3=&HE09
60 DEFUSR4=&HE0C:DEFUSR5=&HE0F
100 A=USR0(0):R=0:T=0
110 CLS:AUDIO ON:MOTOR OFF
120 PRINT"•••* RTTY TERMINAL PRO
GRAM ••••"
130 PRINT"
BYTES"
140 PRINT" SAVE RECEIVE BUFFER
";R
150 PRINT" PRINT ''    ''"
160 PRINT" SHOW ''    ''"
170 PRINT" RECEIVE/TRANSMIT"
180 PRINT" LOAD TRANSMIT BUFFER
";T
190 PRINT" CLEAR ALL BUFFERS"
200 PRINT" BAUD RATE: ";
210 ON B+1 GOTO 220,230,240,250
220 PRINT"45 WPM: 60":GOTO 260
230 PRINT"50 WPM: 67":GOTO 260
240 PRINT"57 WPM: 75":GOTO 260
250 PRINT"74 WPM: 100":GOTO 260
260 PRINT
270 PRINT"DURING RECEIVE/TRANSMI
T:"
280 PRINT" BREAK: RETURN TO THIS
MENU"
290 PRINT" CLEAR: TOGGLE RECEIVE
/TRANSMIT"
300 PRINT" RIGHT ARROW: TRANSMIT
BUFFER";
310 A=C•32:PRINTA+32," ";:PRIN
TA+64,"->";:PRINTA+96," ";
350 FOR I=0 TO 30:NEXT
360 A$=INKEY$
370 IF C>0 AND (PEEK(341) AND 8)
=0 THEN C=C-1:GOTO 310
380 IF C6 AND (PEEK(342) AND 8)
=0 THEN C=C+1:GOTO 310
390 IF A$>CHR$(13) THEN 360
400 ON C+1 GOTO 800,500,550,600,
700,100,950
500 IF (PEEK(&HFF22)AND1) THEN 110
510 A=USR5(-2):PRINT"  ":GOTO 110
550 CLS:A=USR5(0)
560 IF INKEY$='' THEN 560 ELSE 110
600 CLS:PRINT"RTTY RECEIVE    M
ARK->-SPACE":R=USR1(B):GOTO 110
700 S$="LOAD FILE":GOSUB 900
710 IF A$='' AND D THEN 110
720 CLS:PRINT229,"LOADING ";A$
730 IF D THEN F=1 ELSE F=-1
740 OPEN"I",F,A$:A=USR2(0)
750 IF EOF(F) THEN 790
760 LINEINPUT #F,A$
770 A$=A$+CHR$(13):A=USR3(A$)
780 IF A THEN 750
790 CLOSE F:T=USR4(0):R=0:GOTO 110
800 IF R=0 THEN 110
810 S$="SAVE FILE":GOSUB 900:IF
A$='' THEN 110
830 CLS:PRINT229,"SAVING ";A$
840 IF D THEN F=1 ELSE F=-1:GOTO
870
850 PRINT293,"ARE YOU SURE (Y/N
)";:INPUT S$
860 IF S$>"Y" THEN 110
870 PRINT293,'':OPEN"O",F,A$
880 A=USR5(F):CLOSE F:GOTO 110
900 CLS:PRINTS$:PRINT
910 LINEINPUT"FILENAME?";A$
920 RETURN
950 B=B+1:IF B>3 THEN B=0
960 PRINT269,'';:GOTO 210
```

MAKERTTY.BAS
(Formatted 32 Characters Across)

```
10 REM THIS PROGRAM IS PUBLIC DO
MAIN, BY N6LQV
20 PCLEAR4
30 CLS
40 PRINT"  RADIO TELETYPE TRANS
CEIVER"
50 PRINTSTRING$(32,"-");
60 PRINT
70 PRINT"NOW GENERATING MACHINE
LANGUAGE"
80 PRINT
90 PRINT"PLEASE WAIT..."
100 ST=&HE00:AD=ST:LI=900
110 READA$,CS
120 IF A$="X" THEN 200
130 FOR I=1 TO 64 STEP 2
140 A=VAL("&H"+MID$(A$,I,2))
150 POKE AD,A:CS=CS-A:AD=AD+1
160 NEXT
170 IF CS THEN PRINT"DATA ERROR
IN LINE";LI:END
180 PRINT174,949-LI
190 LI=LI+1:GOTO 110
200 IF PEEK(&HC000)=68 AND PEEK(
&HC001)=75 THEN B$="DISK" ELSE B
$="TAPE"
210 PRINT96,"PROGRAM IS NOW IN
MEMORY AND"
220 PRINT"READY TO BE SAVED. INS
ERT ";B$
230 LINEINPUT"AND PRESS ENTER ";
A$
240 IF 8$="DISK" THEN 280
250 CSAVEM"RTTY",ST,AD-1,CS
280 LINEINPUT"PRESS ENTER TO SAV
E AGAIN ";A$
270 GOTO 250
280 SAVEM"RTTY/BIN",ST,AD-1,CS
290 END
900 DATA16003216011516006816006C
160032BDB3EDD76FBE4013BC40152418
A680AD9F,2607
901 DATAA002966F26F1AD9FA00027EB
AD9FA00027FA20E3398D2D8E7FFF9F17
8E40299F,3863
902 DATA048D219E04BF1202BF12C89F
069F08308904009C1723029E179F139F
15DC0483,2591
903 DATA4029204E3404C64020033404
5F1F9B35848E4029BF4004398DEAE684
EE029E04,2792
904 DATA308904009C17242F108E0EBB
A6C03404847FC6FE810D270C8020250E
813F2502,2570
905 DATA8020E6A61F985D1703C63504
5A26DDCCFFFF8DB67EB4F44F5F20F7FF
2D313429,3944
906 DATA803A2B2F3280802C233C3D36
3733212A30352726382E3E8080803980
43594E49,2235
907 DATA414D5A54464B4F525C4C5856
574A4550475E535D5551808080025800F
6215D805,2685
908 DATA2102900DFC13DB04A902550C
44116B0417020B09730D6A03260193BD
B3ED8608,2365
909 DATA3D8E0EFB3AEC84FD1131EC02
FD1158EC04FD1043FD1064EC06FD1092
7FFF4017,3880
910 DATAFF228E03004F6F804A26FB0F
02CCFEF8DD000F0A0F0B8E13739F0E9F
260F220F,2820
911 DATA230F1D8E0420CC6060ED818C
060025F98E05E09F0C86BFA7848E05A0
9F24869F,3412
912 DATAA7841A50170087D62326048D
1620F51CAF17FED6AD9FA00026FAFC40
15B34013,3367
913 DATA16FF0F9E26A6862B3A1F8981
602502C0408D50816026028D449E24A7
808C05C0,3098
914 DATA251A8E0420EC8820ED818C05
A025F6CC6060ED818C05C025F98E05A0
9F24869F,3779
915 DATAA784394C260CC60D8D198660
A79F402420D04C26058E139320064C26
058E1373,2615
916 DATA9F26399E159C172404E7809F
1539962227031700F496232701390F1E
0F1F0F1B,2156
917 DATAC6138D78DC1A8152250721FE
5A2A0A20DD5C2B022003CC007FD71B4F
D61AD31E,2966
918 DATADD1E8300002406AC01AC0120
D3DD1E86059720CC0013971B971C8D40
4FD61AD3,2901
919 DATA1EDD1E830000240FDC1A8152
C900D71B0C1C12C61220E3DD1ED61B58
D11C0621,2752
920 DATA0A2026CFAC94C6088D124FD6
1AD31EDD1E83000025EE962144444439
8D4C4FD3,3140
921 DATA1EDD1ECC00028D42CB028D3A
CB028D36D71AC059502B022003CC0000
C10F2202,2628
922 DATA2003CC000FD11D26063D3DAC
8B20138E0410A68584BFA785961DD71D
E686CA40,3157
923 DATAE78617012639AC01AC018601
5CC1602504A1012005B5FF2027F25CC1
602504A1,2918
924 DATA012005B5FF2026F2398E0405
CE142BA6C0A7808C040D25F7CC343CF7
FF21B7FF,3646
925 DATA018602B7FF200F1E0F1F9E06
9C042724CC0000DD1186059720E6809F
06D7215F,2727
926 DATA8D54AC94CC00085A26FD0421
8D480A2026F2EC9B3DAC8BCC0000DD11
538D3796,3344
927 DATA2226C7CC343CB7FF21F7FF01
8E0405CE1423A6C0A7808C040D25F739
B6FF208A,3731
928 DATA02B7FF20862A971039B6FF20
84FDB7FF208627971039240480E22004
8DEB2000,3444
929 DATA801D4A26FDB6FF2088FCB7FF
20D6104FD31EDD1E931124088D0F9610
802320E2,3601
930 DATADD1E39AC943DAC0139960226
7CDC00C037498A0124022003CCFEF8DD
008E0300,3057
931 DATA3AB7FF02B6FF008A801F89E8
84E48421FEA7848607DD029E049C0626
C69C0826,3805
932 DATAC48E00009F069F089F043996
02263ADC00C037498A0124022003CCFE
F8DD008E,2959
933 DATA03003AB7FF02B6FF008A801F
89E884E48426BEA78496014C27068B37
970121FE,3530
934 DATA20818607DD0216FF7A4A9702
D601CB08D7010403247D867FB7FF0286
FF008440,3295
935 DATA27058E13B320058E13EB2000
A685E6852B289E04980AD70A84602609
C41FE780,3004
936 DATA3D21FE2012C5402604861B20
04861F2000C41FED81A1019F04399E04
5C260E96,2526
937 DATA0A8440970ACC0004E7803D20
EA5C260BCC0802A780ED81A18B20DC5C
2649D622,3280
938 DATA270D8E40299F068E00009F04
9F08393DAC8B39D60B2747C004D70B8E
05E03AEC,2844
939 DATA84ED88E0CC6060ED81EC84ED
88E0CC6060ED84D60B27043DAC84398E
05E09F0C,4453
940 DATA86BFA78421FE395C26060322
AC843D395C26070F220323AC84393DAC
01399E08,2605
941 DATA9C042607CC000C5A26FD39A6
809F089E0EA6862B129E0CA7808C0600
24139F0C,2690
942 DATA86BFA784AC8B394C260F1286
60A79F400C8620970B3D3084394C2609
8E13939F,2987
943 DATA0EA101200B4C26078E13739F
0E20013D3D12398045FF416053495580
44524A4E,2303
944 DATA46434B545A4C57485950514F
4247FE4D5856FD8073FF6D605E787780
6474676C,3436
945 DATA617A68756269726376707179
7F66FE6E6F7BFD8043594E49414D5A54
464B4F52,3457
946 DATA5C4C5856574A4550475E535D
5551258080FDFF363733212A30352726
362E3E2C,2581
947 DATA233C3DFEFCFB808080808080
43594E49414D5A54464B4F525C4C5856
574A4550,3262
948 DATA475E535D5551258080FDFF80
2D313429803A2B2F3280808080839FE
FCFB8080,3659
949 DATA808080524543454956456054
52414E534D495400000000000000000
00000000,1621
950 DATAX,0
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As far as transmitting goes, I have raised the spectre of "spectral purity" of the CoCo audio output in the past. I would limit this version of computer-generated AFSK to VHF. A less-than-perfect sine wave fed into a sideband transmitter often produces spurious signals. To use this on HF, I propose a strictly theoretical solution. Try directly feeding a one-chip AFSK generator, based on one of the function generator chips that outputs a pure sine wave, with a simple PLL decoder, such as the ones presented here in months past. It may not be elegant, but it's cheap and purifying.

Receiving Hardware

You may have to add a stage of external limiting to the audio input. Try a pair of 1N914s across the receiver output back-to-back. Figure 1 is a simple way of doing this. Similarly, the audio output of the CoCo may exceed the mike gain of your transmitter. A resistive attenuator may be required in that instance. Play with the values. You won't hurt anything as long as you're careful.

The cassette relay is used to switch the system from transmit to receive. If there isn't too much voltage on your PTT line, (there shouldn't be with most VHF rigs), you can switch the PTT line directly with the relay. Otherwise, use the cassette relay to key another relay to key the transmitter.

After loading and RUNning RTTY.BAS, you will see a menu with an arrow, moved with the up and down arrow keys, to select the various options. Hit ENTER> to select an option. Those choices with various responses, such as speed, will scroll through each time you hit ENTER>.

With the listings taking up space this month, I think I will pull in the reins rather than give short shrift to some of the topics raised in recent mail. We'll hold that for some of the long winter nights ahead. In the meantime, feel free to reach me on Delphi (MARCWA3AJR), CompuServe (75036,2501), or good old US Mail (enclose a SASE for a reply). See you in February's RTTY Loop!

SPECIAL EVENTS

Ham Doings Across the Country

Special Events listings will be provided by 73 magazine free of charge on a space-available basis. Announcements must be received by us by the first of the month, two months prior to the month in which the event takes place (by March 1, for example, for a May or later event). Please mail to Editorial Offices, 73 Magazine, WGE Center, Peterborough NH 03458.

SOUTH BEND IN
JAN 3

A Hamfest Swap and Shop will be held on Sunday, January 3, 1988, at Century Center, downtown on U.S. 33 ONEWAY North between the St. Joseph Bank Building and the river, South Bend, IN. Four-lane highways to door from all directions. Tables: $5/5ft. Round. $15/8x2.5 Rectangular; $20/8ft. Wall locations. Talk-in Freq: 52-52, 99-39, 69-09, 34-94, 145,29. For more information contact *Wayne Werts K9IXU, 1889 Riverside Dr., South Bend, IN 46616, (219/233-5307).*

MILWAUKEE WI
JAN 9

The 16th Annual Midwinter Swapfest will be held on Saturday, January 9, 1988 at the Waukesha Co. Expo Center Forum from 8 AM till 3 PM. Directions: I-94 to Co. J, south of FT, west to Expo. Admission: $2 in advance, $3 at door. Tables (4 ft.): $3 in advance, $4 at door (electrical outlet $5, as available). Advance deadline January 2, 1988. Dealers welcome. Amateur exams given—write for details. Fine food served at our usual low prices. Sponsered by the West Allis Radio Amateur Club. For tickets or information write: *WAREC Swapfest, P.O. Box 1072, Milwaukee WI 53201 (SASE Please).*

MORRISTOWN NJ
JAN 9–10

To commemorate the 150th anniversary of the first public demonstration of the eletromagnetic telegraph, January 11,1838, by Samuel F.B. Morse and Alfred Vail; the AT&T Bell Labs Whippany Amateur Radio Club and the Bellcore Pioneers Amateur Radio Assn. will operate W2TW on January 9, 1300Z - January 10, 0100Z and January 10, 1300Z-2000Z from Historic Speedwell Iron Works. SSB operation will be in the lower 25 KHz of the General 80, 40, 20, 15 and 10 meter bands, 144.220 MHz, 146.58 MHz FM. CW operation will be in the lower 25 KHz of the General 80, 40, 20, 15 and 10 meter bands. Novice CW operation will take place the first 15 minutes of each hour in the 80, 40, 15, and 10 meter Novice bands, and 10 meter Novice phone. Three HF stations on the air covering all bands. For special QSL card, send QSL and business SASE to K2ASM via callbook.

BETHEL CT
JAN 9–15

In conjunction with National Bicentennial of the Constitution activities and the special "We the People" WAS Award, the Bethel Educational Amateur Radio Society (BEARS), will be operating KZ1Z (KZ200Z), *on* all HF frequencies, using SSB, CW, Packet, RTTY and SSTV modes, in both the General and Novice portions of the bands, during the week of January 9–15, 1988. QSL, with a SASE, to: BEARS, Bethel Middle School, 1 School Street, Bethel CT 06801.

HAMMOND LA
JAN 16

Southeastern Louisiana University ARC and SELARC will hold its annual Hamfest at Southeastern Louisiana Univ. Doors open 9 AM–3 PM on Saturday the 16th. Admission is free. The first table is free. Extra tables are $5. Talk-in on 146.4/147.0. Food and drinks available, dealers, technical and informative forums, and QRRL VE exams. Pre-register for exams by sending Form 610, copy of license, and check for $4.35 to SELARC. Contact: Joe Magro WO5R, 534 Iverstine Lane, Hammond LA 70401.

FORT MYERS FL
JAN 23

Announcing the City of Palms Hamfest. To be held at Moose Lodge Hall #1899, 1900 Park Meadow Drive, Fort Myers FL on the 23rd of January. Talk-in on 146.28/88 (W4LX). *Doors open at* 9 AM. Tables are $10 each and tickets are $3. All reservations should be made before Dec. 15, 1987. Please make check payable to "FMARC". Mail to N.M. Cornwell, Jr., Fort Myers Amateur Radio Club, PO Box 4814, North Ft. Myers FL 33918-4814. Or call 813/332-1503.

SOUTHFIELD MI
JAN 24

The Southfield High School Amateur Club is sponsoring their 20th Annual Swap and Shop on January 24, 1988, at Southfield High School, 24675 Lahser, Southfield MI 48034. Doors open at 6 AM for exhibitors. Open to the public at 8 AM to 3 PM. Admission is $3. Reserved tables are $20 for two 8-ft. tables (paid in advance). Additional reserved tables $10 each. Tables will also be available at the door. Lots of parking, food and door prizes. All profits from this affair will go toward Electronic Scholarships and to support the activities of Southfield High School's Amateur Radio Club. For more information and/or reservations, write to: Robert Younker, Southfield High School, 24675 Lahser, Southfield MI 48034.

INVERNESS FL
JAN 30

The Eighth Annual Citrus County Hamfest sponsored by the Sky High Amateur Radio Club will be held January 30, 1988, at Inverness FL. All functions will be held inside the 10,000 sq. ft. airconditioned auditorium at the county fairgrounds, 4 miles south of Inverness on US Route 41. The building will be open to vendors at 7 AM and open to the public at 9 AM. Ham gear, new equipment, surplus items, rare parts and computers will be featured. Tables are $5, not including admission. Admission is $3 advance and $4 at the door. XYLs admitted free with OM. Food and drink available. Talk-in on 146.355/955. For more information or tickets call Bob Gordon at 904/628-5045 or write SHARC Hamfest, PO Box 572, Lecanto FL 32661.

MARSHALL ISLANDS
JAN 30–FEB 8

The Kwajalein ARC will operate KX6BU from 0600Z January 30 until 0600Z February 8, 1988, to commemorate the 44th anniversary of the battles of Kwajalein and RoiNamur. Frequencies: SSB, 14.250, 21.350, 28.550: CW, 7.050, 14.050, 21.050, 28.050. For $7 KX6BU will issue a QSL, a certificate and a 64-page book on the battles. $3 will bring the QSL and certificate. All requests should be to KX6BU, PO Box 444, APO San Francisco CA 96555.

WHEATON IL
JAN 31

Wheaton Hamfest '88, The Odeum, Villa Park IL. Contact Wheaton Community Radio Amateurs, PO Box QSL, Wheaton IL 60189. Information Phone: 312/629-8006. Tickets are $4 advance with triple prize stubs. $5 at the door. All tables reserved.

YONKERS NY
JAN 31

The Yonkers ARC is sponsoring their Winter Electronics Fair at Lincoln High School on Kneeland Ave., in Yonkers NY. Admission is $3, children under 12 are free. Sellers tables $10 or a $1 a foot, if you bring your own table. Registration in advance for club-provided tables (limited number available). Doors open for sellers at 8 AM; doors open for buyers at 9 AM. Fleamarket hours are from 9 AM to 3 PM. Absolutely no tailgating will be allowed. Talk-in on 146.865 MHz or 440.150 MHz. For more information, contact Otto Supliski WB2SDQ after 5 PM at 914/969-1053.

1988 OLYMPIC GAMES
ALL FEBRUARY

Operators, K6ELX/VX6 and KB6IUA/VX6, employees of ABC's Wide World of Sports will operate from Calgary during the month of February 1988. SSB and CW 10m - 80m and FM on 2m and 220. For special Olympics QSL, PSE QSL via the bureau attention K6ELX or direct to the operators' addresses: K6ELX/VX6 Elliot Block, PO Box 486, Hollywood CA 90028 or KB6IUA/VX6 Chuck Pharis, 9604 Hillhaven Avenue, Tujunga Ca 91042. For direct QSLs a number 10 SASE is a ermust.

HAMSATS

Number 34 on your Feedback card

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
2310 Romayor Court
Pearland TX 77581

A YEAR WITH HAMSATS

Since the first HAMSAT column one year ago this month, I have reported on many amateur satellite topics, such as tracking methods, station profiles including mobile systems, information sources, satellite specifications and activity updates. Much of this information is still valid and useful. If you're new to satellites, check these back issues!

Telemetry

Satellite telemetry, or the report the satellite makes about its general condition, is the only way ground-control stations can monitor the vital signs of our rather remote and inaccessible repeaters in the sky. Once an amateur satellite is launched, it is out of reach for life. By analyzing telemetry data such as temperatures, voltages, currents, power levels and other information, the lifespan of the satellite can be extended if control functions were built into it.

OSCAR 1 was designed with a projected lifespan of 30 days. Even with such a short life expectancy, the designers and observers wanted some form of feedback. The 145-MHz beacon transmitted "HI" in CW. The onboard oscillator (a two-transistor astable multivibrator) incorporated thermistors that would vary the clock rate with changing temperature. By counting the number of times the "HI" was sent each minute, the satellite's temperature could be calculated using a graph or simple formula.

Although today's amateur satellites are far more complex than early OSCARs, we still use feedback for data collection and spacecraft control. Receiving and decoding telemetry sent from the satellite provides insight to the state of affairs onboard the orbiting hamsat.

All amateur radio satellites have used CW for beacons, and most have employed it for their primary method of communicating telemetry data.

UOSAT-OSCAR-9 and -11 are rarely heard transmitting anything except 1200-baud ASCII, but they are both capable of CW at 10 or 20 wpm. They can also generate four other ASCII speeds, 60-wpm RTTY, and a Digitalker voice synthesizer experiment.

The telemetry from Fuji-OSCAR-12 is 1200-baud Manchester-encoded bi-phase PSK (Phase Shift Keying) when in the "JD" or digital mode. However, when in the analog or "JA" mode, CW telemetry reminiscent of AMSAT-OSCAR-8 can be heard on 435.797 MHz.

AMSAT-OSCAR-10 has a software-driven telemetry system capable of any digital code. Morse, RTTY, and PSK were the most common forms heard on the general beacon. Today, even though the satellite is still functioning, the loss of the computer memory has made telemetry impossible. There is only a steady carrier or nothing at all on the beacon frequencies. This type of system, using software to configure the telemetry, will be used on Phase 3C, but with the more expensive radiation-hardened memory chips.

If you'd like to try decoding telemetry, RS10/11 provides full-time CW data on frequencies you can hear with simple and inexpensive equipment.

Since their launch in June 1987, this system, including the host satellite, COSMOS 1861, has provided thousands of contacts for hams around the world. Modes A and K are used more often because there is desense of the 150-MHz command receiver onboard COSMOS 1861 whenever the RS units are switched to Mode T (because of its two-meter output). This leaves the 10-meter downlink as the most commonly-heard signal. Since up to one Watt of output power is allocated to the beacon frequencies, the CW telemetry can be heard by any reasonable 10-meter receiver hooked up to a dipole antenna, or even a piece of wire along the ceiling.

The frequencies used for telemetry are usually 29.357 MHz for RS-10 and 29.407 MHz for RS-11. The CW is relatively easy to copy, but uses a mix of letters and numbers that may cause some confusion. It is best to tape record the signals and play it back later to ensure accuracy.

A complete frame of data includes 16 blocks, each with two letters followed by two numbers. The satellite identifier (RS-10 or RS-11) precedes and follows each complete frame. A sample of actual telemetry as received from RS-10 in early November is shown at the top of Figure 1.

Earlier RS and ISKRA spacecraft used similar data formats. In these satellites, the letters simply designated the channel being sampled. For RS-10/-11 the letters are used to define the status of various systems onboard the spacecraft. Previous satellites used numbers to define voltage, temperature and other readings taken from sensors on the satellite. This has not been changed. The lower portion of Figure 1 shows the information obtained when all the letters and numbers in the upper portion have been decoded.

Decoding a single frame of data provides a snapshot of conditions onboard. Decoding several frames during a pass gives a moving picture view of the satellite's systems. Voltages and temperatures may fluctuate as the satellite moves from sunlight to darkness. Watching frames from consecutive orbits may show modifications implemented by ground control stations in the Soviet Union to the transponders and beacons in the satellite.

Next time you are on RS-10/-11, check the beacon frequency and collect a few frames of telemetry. To convert the raw telemetry blocks to functional form, use Table 1. As an example of how to use the table, find Block 9 in the raw telemetry from Figure 1. It

```
RS10 raw CW telemetry:
RS10  NS81 NR00 ND10 NG45
      NU45 IW00 IK00 I000
      AS36 AR27 AD40 AG35
      MU00 MW46 MK46 A089

RS10 telemetry after decoding:

Data sampling period is 10 minutes.
20 dB receive attenuator is out.
10 dB receive attenuator is out.
15 Mtr receiver is on.
2 Mtr receiver is on.
Special service channel is off.
10 Mtr beacon power is 1 Watt.
2 Mtr beacon power is 1 Watt.
First memory board is off.
Second memory board is off.
Special channel memory status is open.
Code store memory status is open.
Memory output is to 10 Mtr beacon.
15 Mtr ROBOT rcv. atten. is off.
2 Mtr ROBOT rcv. atten. is off.
Special service ch. xmtr pwr is 1 Watt.

Main power supply voltage is 20.25 Vdc.
2 Mtr power output is 0 Watts.
10 Mtr power output is 1 Watt.
15 Mtr receiver AGC voltage is 9 Vdc.
2 Mtr receiver AGC voltage is 9 Vdc.
Special channel rcvr voltage is 0 Vdc.
10 Mtr command mode is off.
2 Mtr command mode is off.
10 Mtr xmtr temp. is 26 deg. C.
2 Mtr xmtr temp. is 17 deg. C.
Main PSU temp. is 30 deg. C.
9V rcvr PSU temp. is 25 deg. C.
Backup receiver voltage is 0 Vdc.
15 Mtr ROBOT rcvr IF voltage is 9.2 Vdc.
2 Mtr ROBOT rcvr IF voltage is 9.2 Vdc.
Robot QSO counter shows about 80 QSO's.
```

Fig. 1. Raw and decoded RS-10 telemetry.

reads "AS36". Checking with Table 1, the letters portion of the block show that the first memory board is off. When decoded, the numerical portion of the block yields the temperature, in degrees Celsius, of the ten-meter transmitter. Using the equation T = (N - 10), where T is the decoded temperature and N is the two-digit number in Block 9, the result is a comfortable 26 degrees C.

A few of the telemetry blocks require explanation. The receiver attenuators referred to in the letter status indicators for Blocks 2 and 3 can be used in combination giving four possible signal input levels instead of three. By using them together, as much as 30 dB of receiver attenuation can be switched in. Other configurations are 0-, 10- or 20-dB attenuation. The ROBOT receiver attenuators shown in Blocks 14 and 15 are only single-stage 10-dB types.

The ROBOT QSO counter noted in the number conversion column of Table 1 is quite different from those in RS-5 and RS-7. In the earlier satellites, the telemetry presented the number of contacts logged by the autotransponder. The number could increment to a maximum of 99. With RS-10/-11, the counter will show "00" until at least 32 QSOs have been made. At that point the telemetry number in Block 16 will show "80". As the counter approaches "99", the actual number of loggings will be rising from the thirties up to 128, the maximum number of callsigns the memory will hold. Before the memory is filled up, the ground control station will download the list of callsigns worked by the ROBOT.

A slightly modified form of telemetry may be heard if you listen while a command station has access to the satellite. All of the leading letters in each block will have an extra dot or dash added. If the command station is accessing via 15 meters, a dot is added, turning an I to an S, or an N to an R. If the control station is on two meters, the I will become a D and the N will change to G. This also applies to the other leading letters. Here in the states, the modified telemetry will be hard to hear since there are no western-hemisphere command stations. However, with enhanced ten-meter propagation, it may be possible to monitor the downlink while the satellite is over the Soviet Union.

> ***"Certain blocks of the RS-10/-11 telemetry can be quite useful."***

Decoding telemetry may seem to be only a tool for ground controllers or a curious exercise for serious satellite chasers. This is not the case. Certain blocks of the RS-10/-11 telemetry can be quite useful even for those interested only in making contacts through the transponder. A quick look at the letters in Blocks 4 and 5 will indicate which radio to use for the uplink. In Figure 1, these two blocks showed "NG" and "NU" respectively. From Table 1, note that these letter status indicators state that both the 15- and two-meter receivers are active. Instead of testing an uplink band to see if it is being received by the satellite, a quick look at the telemetry can save time.

Another group that finds the telemetry useful are those in education. What better way to explain orbital mechanics to high-school students, than to actually predict orbits and then listen to a satellite and decode its telemetry?

More information on the telemetry of the other hamsats can be found in the Satellite Experimenter's Handbook by Martin R. Davidoff and the JAS-1 Satellite Handbook. Both are available from AMSAT. A computer program for the PC and PC compatibles is also available from AMSAT. It will capture and decode U-O-9 and -11 telemetry when used in conjunction with a modem and two-meter-FM receiver.

Updates

A-O-10 was released for guarded use in mid-November. The batteries appear to be in good shape and the Mode-B transponder is working well. The DX is out there! Check the AMSAT nets for scheduling since there is some rather serious eclipsing and satellite activity must be avoided during that time.

FO-12 continues with a mix of JA, JD and recharge time. Recent schedules have worked well. Once again, check the nets for the latest information.

Block #	Latter Status Indicators	Number Conversion Bquations
1	IS - Data sampling per. is 90 min. NS - Data sampling per. is 10 min.	Main (20 Vdc) power supply voltage V = N/4 Vdc
2	IR - 20 dB rcv. atten. is in. MR - 20 dB rcv. atten. is out.	2 Mtr transponder power output P = N/10 Watts
3	ID - 10 dB rcv. attea. is in. ND - 10 dB rcv. atten. is out.	10 Mtr transponder power output P = N/10 Watts
4	IG - 15 Mtr receiver is off. NG - 15 Mtr receiver is on.	15 Mtr receiver AGC voltage V = N/5 Vdc
5	SU - 2 Mtr receiver is off. NU - 2 Mtr receiver is on.	2 Mtr receiver AGC voltage V = N/5 Vdc
6	IW - Special service channel off. NW - Special service channel on.	Special service channel voltage V = N/5 Vdc
7	IK - 10 Mtr beacon power is 1 W. NK - 10 Mtr beacon power is 0.3 W.	10 Mtr command mode on/off 00 = OFF, any other numbers = ON
8	IO - 2 Mtr beacon power is 1 W. NO - 2 Mtr beacon power is 0.3 W.	2 Mtr command mode on/off 00 = OFF, any other numbers = ON
9	AS - First memory board is off. MS - First memory board is on.	10 Mtr transmitter temperature T = (N - 10) deg. C.
10	AK - Second memory board is off. MK - Second memory board is on.	2 Mtr transmitter temperature T = (N - 10) deg. C.
11	AD - Special channel mem. open. MD - Special channel mem. closed.	Main (20 Vdc) PSU temperature T = (N - 10) deg. C.
12	AG - Code store momory is open. MG - Code store memory is closed.	9V receiver PSU temperature T = (N - 10) deg. C.
13	AU - Memory output to 10 Mtrs. MU Memory output to 2 Mtrs.	Backup 9V PSU voltage V = N/5 Vdc
14	AW - 15 Mtr ROBOT rcv. atten. in. MW - 15 Mtr ROBOT rcv. atten. out.	15 Mtr ROBOT receiver IF voltage V = N/5 Vdc
15	AK - 2 Mtr ROBOT rcv. atten. in. MK - 2 Mtr ROBOT rcv. atten. out.	2 Mtr ROBOT receiver IF voltage V = N/5 Vdc
16	AO - Special Ch. power is 1 W. MO - Special Ch. power is 0.3 W.	ROBOT QSO counter: 0-32 QSO's=00 32-128 QSO's yields 80-99

Fig. 2. Telemetry decoding definitions and equations for the RS-10 and -11 satellites.

Number 35 on your Feedback card

73 INTERNATIONAL

Edited by Richard Phenix

73 INTERNATIONAL BEGINS 6TH YEAR

April, 1983: Listing nations in world geographic order, from East to West (a silly idea soon dropped—the starting point wasn't even the International Date Line), the first International section appeared with news from India (VU2CZ), Hong Kong (VS6HJ), Taiwan (BV2A/BV2B), Republic of Korea (HL9KT/KH2AC), Papua New Guinea (P29NSF), Guam (KH2AR), New Zealand (ZL2VR), Chile (CE3GN), Brazil (PY1CC and PY1APS/PY7APS), Switzerland (HB9MQM), Federal Republic of Germany (DJ8BT and DJ3NW), Austria (OE3REB), and Sweden (SMØCOP). Seven of these countries continue to write in often and regularly, and ZL2VR, PY1CC, PY1APS, DJ3NW, and SMØCOP are still faithful representatives for their nations. Other faithfuls came soon: Australia (VK3YJ), Czechoslovakia (OK3KFO ARC), Greece (SV1IW), Israel (4Z4MK), to name those both faithful and frequent.

There were 38 nations appearing in the section in 1983, and to date a total of 71 countries have appeared. Some places, like Antarctica, showed up only once. Others dropped out when their correspondent moved (Liberia) or became too involved in other activities (Papua New Guinea), and no replacement took over. (The International Editor offered to go find replacements, but the travel budget didn't permit, and his reasonable suggestion that money be found by publishing only ten issues of the magazine each year was rejected for some reason.) Five new nations joined the International Club in 1987.

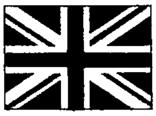
We look forward to more nations in 1988. New correspondents will receive courtesy subscriptions to *73 Amateur Radio* in return for a minimum of four columns over a 12-month period. Let's hear from you!

Reminders! Deadlines: Your material must be received by the **first** of a month to be considered for inclusion in the issue for two months later. **January** 1 for the **March** issue, for example. *But short items or FLASH news items ("Ham QSOs mysterious object in space....") probably can be slipped in if received by mid-month.* Do not ever write on the backs of photographs! Photos cut out of other magazines, newspapers, etc., cannot be used, for technical reasons. Type your material and double-space it. Two to three pages (double-spaced) is long enough.

NOTES FROM FN42

73 International begins a new service this month: to hams who plan to visit other countries and want to operate while traveling. See details elsewhere!

January First is Happy: New Year, Nouvel An, Neujahr, Ano (with a wiggle over the n) Nuevo; there are Independence Days for Haiti on the 2nd, Burma on the 4th, and Nauru on the 31st. And a few more celebrations to mention during the appropriate DX contacts: January 7—Ethiopian Christmas; 9—Martyas Day, Panama (Nepal has this on the 29th); 15—Adult's Day, Japan; 20—National Heroes Day, Guinea-Bissau; 24—Economic Liberation Day, Togo; 25—National Holiday, Australia; 26—Anniversary of the Proclamation of the Republic, India.



BRITISH WEST INDIES MONTSERRAT

Errol "Bobbie" Martin VP2MO
PO Box 113, Plymouth
Montserrat, British West Indies
Leeward Islands, Zone 8

[The following concludes the report started in the November issue, in which VP2MO, now in charge of all amateur radio matters in the Ministry of Communications and Works, pointed out that operating on January 1, a holiday, is legal ("You bet your ever-loving COAX it is!") even though all licenses expire every December 31st and can't get renewed until January 2nd—and OSL cards dated on January 1st are valid for DXCC.]

The licensing authorities are aware of the situation and allow it to continue. To allow is to permit, right? And does this administration have anyone else to satisfy besides itself? Hell, no, and it couldn't care less what anyone else thinks. The administration has NOT declared anything about the operating to be illegal. Understand?

About those countries where operating amateur radio is itself illegal—outlawed: Our constant hope is that we all can educate them so that they become favorable toward amateur radio and eventually will become a part of this fraternity. There is danger that we are prolonging the wait for this conversion, however, in the way we comport ourselves in our day-to-day air contacts with each other. We are not doing a very good job as ambassadors.

Heck, we are fooling ourselves if we think the world isn't hearing us...it hears us...and what is heard is not too inviting. Trying to get through that pileup is fun—it's good for you to physically shout out all the tension that has built up at work, or wherever, but cussing the other guy out in public is not "meeting people and making friends."

I have heard the term "lid" used, and the tone of voice gave me an indication that it was not a good-morning greeting. We have just got to work on cleaning up our act if we are going to show the world what a good thing we have. If we want to make enemies all we have to do is go down the street and break somebody's window. We have a local saying, "You can shake a man's hand but not his heart." So all I ask is that we extend a hand, and if we are not too sure about it, keep your heart concealed. In other words, keep your garbage off the air, it doesn't belong there!

[I bet that in his DX contacts, VP2MO sends appropriate greetings from the "Notes from FN42" calendar section which always starts this column.—Ed.]

PEOPLE'S REPUBLIC OF CHINA

Chang Han Dong (BY4AOM)
Institute of Estuarine & Coastal Research
East China Normal University
Shanghai 200062
China

Han Dong sends the following hoping it will be "helpful for readers, particularly in the Western World, to understand about Chinese amateur radio."

In the five years since 1982, when ham radio activities were resurrected, about 30 ham stations were set up, one after another, and more and more people are interested in the hobby. Chinese amateur radio still has a long way to go to catch up with foreign countries.

As early as the 1930s, amateur stations appeared in China. Amateurs used transmitters made by themselves to contact each other and foreign stations. All of them worked in CW. However, these good times did not last long. The Second World War broke out, the great War of Resistance Against Japan (1937–1945) began throughout China. Many amateurs joined the war effort and gave of their full professional knowledge and skills. Postwar, some amateurs were cited for their distinguished service.

After 1945, amateurs began activity again, working in CW and AM phone, and the China Amateur Radio League (CARL) was set up. There were many advances made in amateur radio in those years. After 1949, however, owing to the situation at that time, amateur stations were called off temporarily. In the 1960s, BY1PK was on the air, and in 1982, the government declared that amateur stations were allowed to resume, and BY1PK and then other stations were set up. In Shanghai, some old men who had their own licenses before 1949 organized a club station, BY4AOM (Able Old Men).

All radio amateurs in China are united in CRSA—the China Radio Sports Association, and branches of CRSA are set up in every province and municipality directly under the Central Government. Its major tasks are organizing and planning amateur radio activities, approving license applications, QSL services, etc. Since we are new, we have no contests yet in China, but Chinese amateurs often join international contests, and CRSA often organizes CW contests, fox hunting (80m, 2m, 160m), and model ship and plane building. Ham stations in China are usually in touch with each other every Thursday on 14.330 MHz.

BY is the prefix for club stations, BG for private amateur stations (we have none at the moment, but

all the hams in China look forward to having BG stations on the air as soon as possible), and B7 is for special stations.

In China, the National Radio Management Committee (NRMC) corresponds to the American FCC, so applications for amateur licenses go to it for examination and approval. The CRSA now is drawing up the necessary laws and rules and regulations which will strengthen amateur station activities.

Among the some 30 stations are two university stations, the old-timer station (AOM), and some children's stations: BY1SK, BY4AY, BY4ALC, and so on. These are set up in the Children's Palaces, and the members are secondary school students who study elementary radio, English, constructing a receiver, and station operation. A recent report is that some young hams in the Chao Yian Children's Palace of Peking, under the leadership of their teacher, have made a kind of satellite receiver that can receive NOAA meteorological satellite signals of the USA, and the polar-orbiting meteorological satellite of Japan.

There are many radio direction-finding contests (RDFs) and model plane and ship contests, and the West Lake Cup RDF invitational tournament every year. Also, BY1PK (Peking) and BY4AA (Shanghai) provide the Hong Kong-to-Peking automobile race and international marathon race with their communications services. In 1985, BTØNMN joined the China/Japan Mount Namunani United Mountaineering Expedition. [See *73* International, August, 1987.]

Amateur stations resumed in Taiwan also, around 1983. There are about 20 stations there, now, some of which had licenses before 1949 when they lived on the mainland of China. BV is the Taiwan prefix, and many times I have tried to make QSOs with them and always met with defeat. Later I learned that the Taipei government does not permit BV stations to contact BY stations. I think (hope) this will change soon.

American hams and Japanese hams have given much help to Chinese amateurs. They have presented transceivers and antennas and have conducted many training courses, helping the Chinese hams to understand new technologies—we are very thankful. Owing to the years that activity was suspended, we have fallen far behind in techniques, experience, equipment, and education. I received a letter from a secondary school student in Peking the other day. He said, "I am very interested in ham radio, but I don't know how I can do and I am short of direction [guidance] ...."

The Chinese often say: *Everything's hard in the beginning,* but there also is a proverb in China that says "It all depends on human effort."

GREAT BRITAIN

Jeff Maynard G4EJA
32 Waldorf Heights
Hawley Hill
Camberley GU17 9JQ
England

THE UK SCENE

This morning I was looking for some information on satellite orbital parameters. Needless to say, just when I wanted it all my available information was out of date. After spending a few minutes cursing my own poor filing system, I remembered that an alternative source of information lay on my desk.

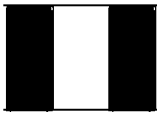
I refer to my "Displayphone," which as well as being a fully-equipped telephone can act also as a simple data terminal. In particular, it serves as a monochrome-only Viewdata terminal. (You will recall that Viewdata—called Prestel in the UK—operates using a V23 modem with asymmetric transmission speeds of 75 and 1200 bits per second.) Although Viewdata graphics are crude by modern PC standards, my interest for data only should have been satisfied easily. I decided, therefore, to access the Radio Society of Great Britain (RSGB) mailbox. This is open to anyone with a compatible (V23) terminal by dialing the UK number, 0707 52 242 (from the US, 1 44 707 52 242).

I must confess that I was not completely sure that my needs would be met. Previous experience with other Viewdata systems had left the feeling that information was seldom up-to-date and that routings (the linkages between "pages" of display material) were often incomplete. I should say at once, therefore, that the RSGB scores very well on both counts. Information which I retrieved was only 24 hours old in some cases, and in no case did I find myself lost because of missing or incomplete routings.

It had been some time since I used the RSGB service, and my first impression was of the much wider range of topics covered. The main index lists (among many items) band plans, diary dates, club information, repeaters, and beacons. It was to the last that I turned now. Again I was impressed by change: the continued expansion of the packet repeater network. I noticed that GB3UP in Guilford is operating within range of my home (on 144.650 MHz, in common with most other packet repeaters). I intend to access it in due course and will report on it here.

Incidentally, anyone particularly interested in packet and/or digital radio might like to consider subscribing to the RSGB latest newsletter, *Connect International*. It is published on the 15th of each month and is available on subscription to members and non-members, with airmail available outside of Europe.

After browsing through a wide range of topics across many, many pages of information (the format is generally such that one can regard the display as giving information rather than just data), I remembered my original need—the satellite orbital data. The satellite sub-index lists a whole range of topics covering basic background information through to fairly up-to-date news about this exciting technology. There also are orbital predictions for the next month or so, together with Keplerian elements (for the keen ones with a powerful PC!). These are available for the OSCAR and RS series, MIR, Salyut, and Ajisai. My original need was well satisfied, with extensive and up-to-date information!



ITALY

Mario Ambrosi I2MQP
Via Stradella, 13
20129 Milan
Italy

The Italian Island Award (IIA) started its life about four years ago. Since then, more than 200 have been issued, most of them to Italian amateurs—only 10 have gone to US hams. To get it, DX operators must get confirmation of contacts from 15 islands, situated in at least three groups of Italian islands. Stickers are available for mode (SSB, CW, MXD) and band.

Honor Roll is available if you contact 80 islands in at least 13 groups, and a nice plaque, the AIIA (All Italian Island Award), is issued for 150 islands and 17 groups. As of today [September, 1987] there are 248 islands on the list (available for SAE plus IRC) located in 18 groups, but the number can increase if there is activity from other islands.

The cost of the award is US$5 or

I2DMK and Italiano Honor Roll Award.

I2BVS and his son, I2NYN.

Italian Island QSL cards.

10 IRCs; the stickers can be sent for an SAE plus IRC; the plaque is US$30, postpaid.

There is quite a lot of activity all year long, but mainly during the good season, around these awards. In 1986, more than 40 expeditions took place, and 1987 totals probably will be about the same. You should know about a few of the most active people. First is Max I2DMK, for whom I am QSL Manager. He has activated more than 30 islands up to now, and the QSL cards are much in demand. He is a journalist and owns a small company which publishes three magazines devoted to sports (particularly to skiing), and he goes on the DXpeditions with his son, Marco I2NYN and an old friend, Enzo I2BVS. They are mainly on CW, but they also like some phone operation.

SAN MARINO

Do you have any T7 cards and don't know where to send them? Here is a short list of San Marino addresses; I hope you can find what you want.

To all addresses except the one indicated, add "47031 Republic of San Marino." (47031 R.S.M. is adequate locally. [*And if you wish to be exactly accurate, the official name of this independent, 24 sq. mile, 23,000 population nation which is entirely surrounded by Italy, then add, "47031 Most Serene Republic of San Marino."—Ed.*]

T77B	Mario Graziani—via WA3HUP
T77C	Tony Ceccoli, Via Delle Carrare 67, Murata
T77D	Giovanni Mario Reffi, Porta San Francesco, San Marino
T77E	Alvaro Zafferani, Via E. Retosi 16, Fiorina
T77ET	Vincenzo Zafferani, Via Fondo Bandiera 24, Borgo M.
T77F	Henry Franciosi—via I2WWW, ARI, Via Scarlatti 31, 20124 Milan, Italy **(Do not add 47031 San Marino!)**
T77G	Giuseppe Greco, Via Monte Seghizzo 31, Fiorentino
T77I	Ivo Grandoni—via I0BNZ
T77J	Guiliano Giacomoni, PO Box 1, Dogana
T77M	Lino Conti, Via G. Barbieri, Dogana
T77SR	Salvatore Berti, Via F. Mestica, Borgo M
T77T	Pier Paolo Taddei, Via A. Lincoln 64, Borgo M.
T77U	Stefano Leardini, Strada Alvania 30, Dogana
T77V	Piergiovanni Volpinari, Via G. Gioacomini 59, San Marino
T77W	Paolo Boffa, Via Dell'Attuaro, Falciano
T77Y	Maurizio Boffa—via I0MWI
T77Z	Roberto Capicchioni, Via Tana 15, San Marino
T70A	Radio Club, PO Box 77, San Marino

The Italian Islands Award issued for working 15 islands in three groups. Only ten awards have gone to U.S. hams.

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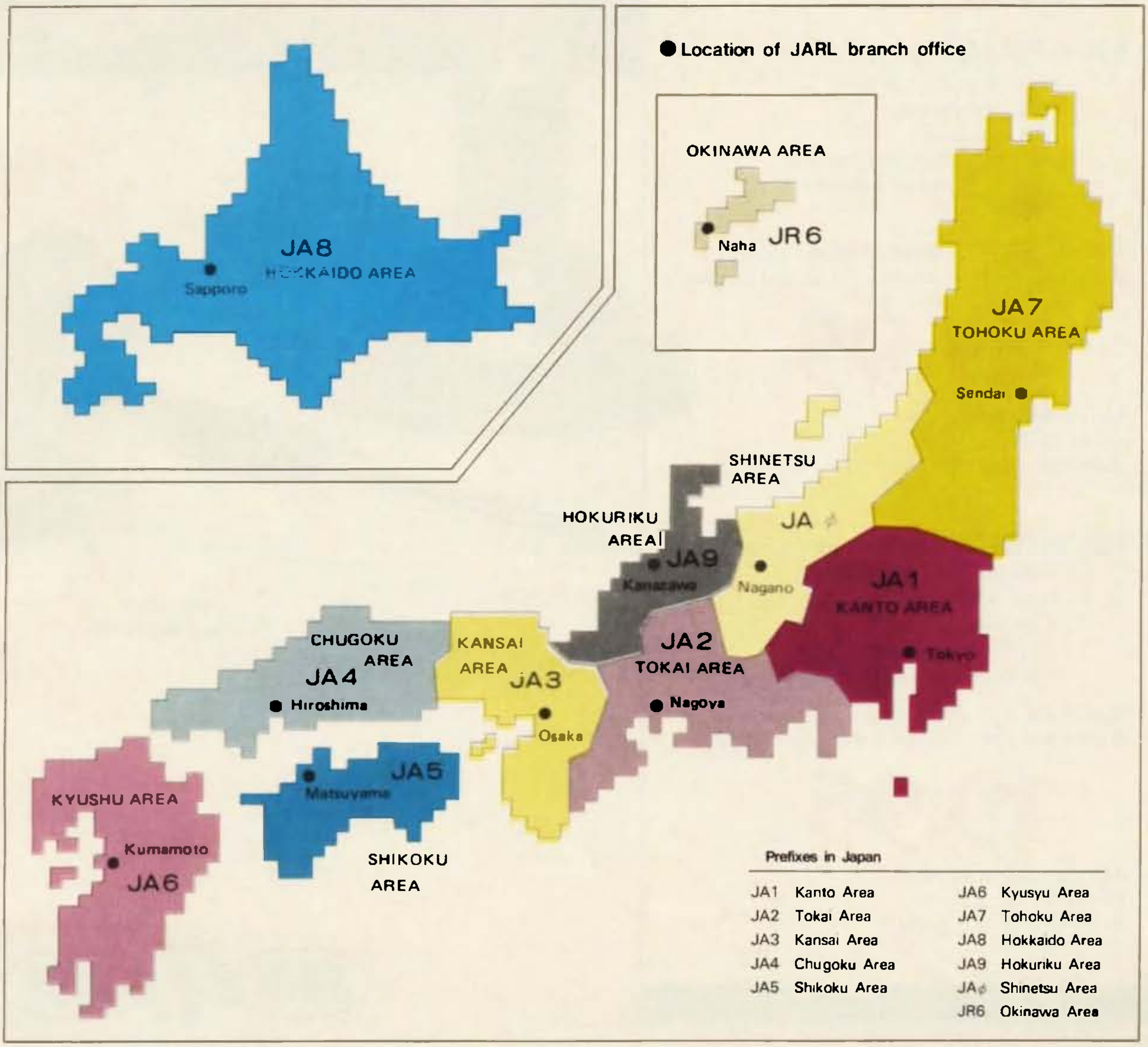
(Including "Roundup" and "Notes from FN42" References)



Japan's call areas. (From Amateur Radio In Japan, *published 1986, JARL, 14-2, Sugamo 1-chome, Toshima-ku, Tokyo 170, Japan.)*

AERIAL VIEW

Antenna News

Arliss Thompson W7XU
7314 SW 28th Ave.
Portland OR 97219

THE PROBLEM

OK, let me get this straight. Your HF transceiver has a bandswitch with 8 positions, but you have room for only one or two antennas. Even if you had the space for several antennas, you couldn't afford the coax to feed them after straining the family budget to get that tower and tribander. Besides, somehow your spouse got the idea that that tribander was going to be the antenna, "so why do you need all those ugly wires running all over the yard?" A dipole fed with open wire line through an antenna tuner is one possibility, but you don't have a tuner and open wire line can be a bit of a hassle. A trap dipole is another way of dealing with this situation, but traps can be a little spendy and they are sometimes tricky to build. Are there any other possibilities?

One alternative is to feed several dipoles that are connected in parallel with a single coax feedline. I've built several such parallel dipoles, but as noted elsewhere (Grebenkemper, QST, May 1985), parallel dipoles typically have a narrower bandwidth than trap dipoles do. Also, being in close proximity to one another, they tend to interact and you can end up with some combinations where you can't get a reasonable SWR no matter how much antenna pruning you do. This is especially likely to happen when the bands involved are relatively close to one another in percentage terms. For example, I recently built a 20/15m combination using 300-Ω twinlead (Figure 1), and although the antenna worked great on 14 MHz, I couldn't get the SWR below 2:1 on the higher band despite numerous rounds of lowering, trimming, and raising the antenna. However, a little time spent at the library and with a soldering iron cured my problem. Here's what I did.

A Solution

I came across a paper that reported good success with parallel dipoles when a capacitive balun was connected across the antenna's input terminals (Hately, "Multiband Dipole and Ground-Plane Antennas," in Third International Conference on HF Communications Systems and Techniques, IEE, London, 1985, pp.102–106). An example of such an antenna appears in Figure 2. The capacitors at the antenna feedpoint are chosen so their reactance is equal to the impedance of the coax feedline at the frequency of interest. When operating on the highest frequency band, only capacitors C3A and C3B are involved, along with the dipole formed from L3A and L3B. On the next lower band C2A and C3B are effectively in parallel. Their combination (and C2B, C3B) is chosen to have a reactance (at this lower frequency) equal to the coax impedance. Finally, on the lowest frequency band, C3A, C2A and C1A (and C3B, C2B, C1B) act together to supply the necessary capacitive reactance, while L1A and B resonate as a dipole on that band.

Confused by all those capacitors? To spare you the number crunching, I've calculated the capacitor values required for the 9 HF bands when using 52-Ω coax feed (see Table 1). Note that the table gives the total value of capacitance needed on each band. Once you've supplied the capacitor for the highest frequency operation, a lower band requires only enough additional capacitance to reach the total shown in the table.

For example, Table 1 indicates that 144 pF is needed for 15m operation, and 216 pF on 20m. Therefore, when I built a 20/15m combination, I used a 144-pF capacitor with the 15m section, but only a 72-pF unit with the 20m section, since 144 + 72 = 216 pF. A 80/40/30m combo would have 303 pF capacitors for the 30m section, 125-pF capacitors for the 40m section (303 + 125 = 428 pF), and 377-pF capacitors for the 80m section (303 + 125 + 377 = 805 pF). You can use the information in Table 1, therefore, to arrive at capacitor values for any combination of parallel dipoles in the HF band.

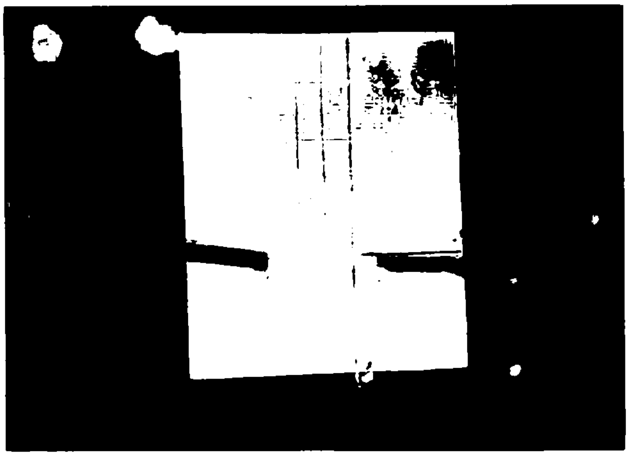


Photo A. Copper-clad board capacitor for the parallel dipoles.

Roll Your Own

The capacitors you use can either be of the commercial value (rated to handle the expected current and voltage), or homemade. Making your own is not as difficult as you might think. As you can see in Figure 2, the capacitors all have one plate in common, and that plate is connected to the shield of the feedline. With my homemade capacitor, that common plate is one side of a double-sided copper-clad board. The other plate of each capacitor is etched (or cut out with a hand-held grinding tool) on the opposite side of the copper-clad board. I also etched some additional small areas on the non-ground side of the board in case I needed to add some capacitance to the system. (I didn't). My capacitor, in the testing phase, appears in Photo A. Prior to permanent installation, of course, a more sound mechanical arrangement than that shown in the photo should be arranged, and the capacitor should be located in a waterproof housing.

The area of copper-clad board necessary to obtain a given value of capacitance will depend on the characteristics of that particular type of board. If you have an LC meter, or if you know the dielectric constant for the board and the separation between layers of copper, you can calculate the surface area needed for a given value of capacitance. However, I got my board from a surplus dealer and I

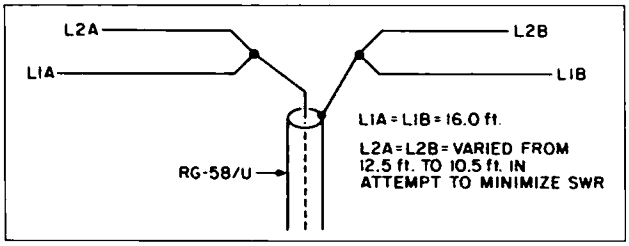


Fig. 1. Parallel dipole antenna for 20- and 15-m bands constructed from 300-Ω twinlead. Performance was good on 14-MHz, but unacceptable at 21 MHz. See text for details.

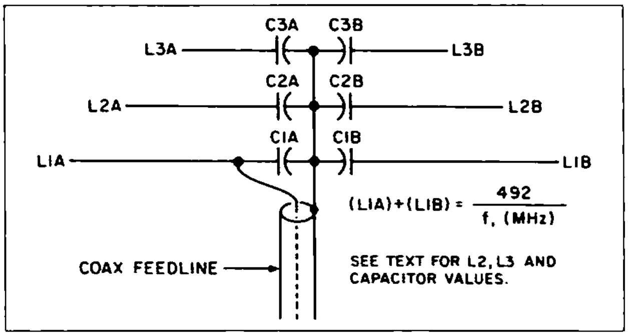


Fig 2. Parallel dipole antenna with capacitive balun. Note that the center conductor of the coax is connected to only one side of one capacitor, while the shield is common with one side of all the capacitors.

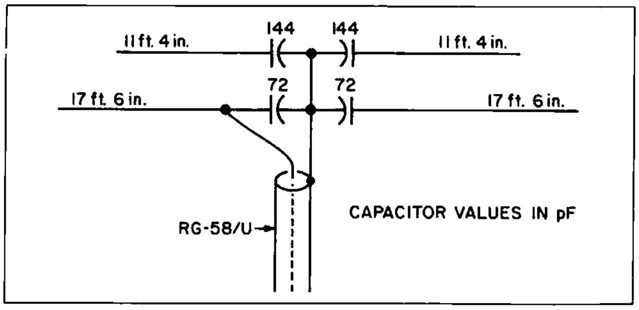


Fig 3. Parallel dipole with capacitive balun feed for the 20 and 15-m bands. Elements are made of 300-Ω twinlead cut to the lengths shown. This antenna provided a low SWR at both 14 and 21 MHz, unlike the arrangement shown in Figure 1.

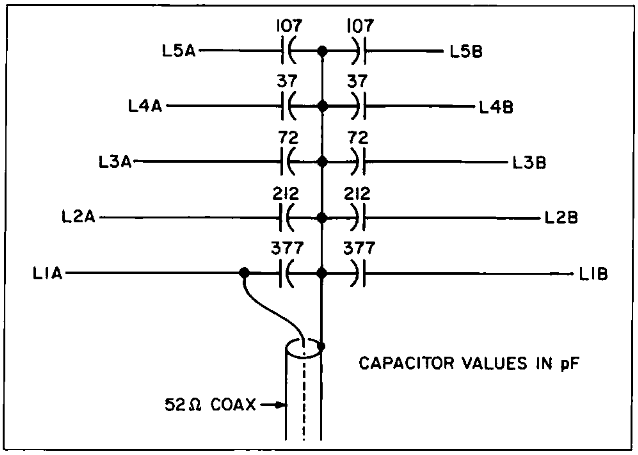


Fig 4. Parallel dipole with capacitive balun feed for the 80/40/20/15/10-m bands. Such an antenna could be constructed from 5-condutor rotor control wire.

knew nothing about its characteristics. Still, I had no difficulty making the capacitors.

First, I took a section of coil stock and soldered an end to each side of the virgin circuit board. Using a grid-dip oscillator, I found the resonant frequency of this LC circuit. I then removed the coil from the board and soldered a capacitor of known value across the leads of the coil, and again found the resonant frequency. Some simple calculations then yielded the capacitance per square inch of the circuit board.

Specifically, I placed a 9-turn coil, 1 1/2" diameter, 1 1/4" long (dimensions are unimportant, just don't change the coil once you start this), across a fairly large sheet of double-sided board. Its resonant frequency was 1.73 MHz. I then removed the circuit board and replaced it with a 680-pF silver mica capacitor. The frequency was 3.80 MHz. Dividing 3.8 by 1.73 and squaring the result yields 4.825. Since the circuit board/coil combination gave the lowest frequency, I multiplied that 4.825 by the 680 pF and got 3280 pF as the capacitance of my board. (Had the circuit board/coil pair produced the highest frequency, I would have divided 680 by 4.825). Dividing the area of the board by its capacitance gave a value of 18.56 pF per square inch. Therefore, to make a 185.6-pF capacitor, I would need 10 square inches of copper.

Frequency	Total C (pF)
28.5	107
25.9	118
21.3	144
18.1	169
14.2	216
10.1	303
7.15	428
3.8	805
1.8	1700

Table 1. Design information for parallel dipoles with capacitive balun and 50-Ω coax feed. The total capacitance column indicates the value of capacitance that should appear each side of center for a given band of operation.

"If you've tried parallel dipoles before with limited success, maybe you should give this method a whirl."

For my 20/15m antenna, I needed two 144-pF capacitors and two 72-pF caps. Since each square inch of my circuit board provided 18.56 pF of capacitance, that meant I needed two areas of about 7.75 square inches each, and two of 3.9 square inches each. The actual shape of those areas is unimportant so long as their areas are correct.

Anybody There?

Are you still with me? Believe me, it takes longer to describe the process of making those capacitors than it does to actually manufacture them. Sure, you can go buy some capacitors, but even then you may have to make some series/parallel combinations to get the required values. By making my own capacitors I was able to get just the values of capacitance I needed, plus it was cheap and worked the first time I put it on the air. That's hard to beat.

A few comments on the lengths of wire required for the dipoles. Normally when we make a half-wave dipole it is cut according to the formula length (feet) = 468 ÷ frequency (MHz). However, as noted in Figure 2, when using this antenna you need to use length (feet) = 492 ÷ frequency (MHz) to calculate the length of the lowest frequency dipole. This change is necessary due to the effects of the capacitors at the antenna input terminals.

With my 20/15m antenna, that meant a length of 17.5ft each side of center for the 20m dipole (resonant frequency 14.050 MHz). Hately stated that the other dipoles in one of these systems need to be lengthened 5 to 15 percent due to the "parallel inductance" effect caused by the other nearby conductors. With my 2-band antenna, however, resonance on 21 MHz was achieved with a length 3% greater than the traditional 468 x frequency value, or 22′ 8″ overall for 21.3 MHz.

So where are we? Figure 3 shows the completed 20/15m parallel-wire dipole. The antenna was raised to 32 feet above ground and worked well, with a good SWR across both 20 and 15m, on the first try. It did not require any adjustment of capacitance from the calculated values. I suppose I could wave my hands and explain why this second arrangement of parallel dipoles worked when the combination lacking the capacitors wouldn't. But I'm not sure that I'd convince either of us. Regardless of how it works, if you've tried parallel dipoles before with limited success, maybe you should give this method a whirl.

Other Ideas

This method could also be applied to vertical antennas. Hately claimed that multiband quarter-wave ground plane antennas using this technique outperformed other verticals that used "tuned traps and loading coils." It should be possible to design multiband VHF/UHF whips, with the capacitors formed gamma-match style from telescoping tubing. Or perhaps one of you readers has a better idea. Any takers?

Frequency (MHz)	SWR:1
3.6	1.45
3.7	1.22
3.8	1.80
7.0	1.20
7.05	1.12
7.1	1.25
14.0	1.40
14.2	1.19
14.3	1.40
21.0	1.23
21.2	1.33
21.4	1.55
28.0	1.55
28.5	1.02
28.8	1.42

Table 2. SWR figures for a 5-band parallel dipole antenna, 50-Ω system, with capacitive balun (from Hately).

by Chod Harris VP2ML

Novice DX Primer

Tips for Novices to Work the World on Voice

DX. The mere mention of the word starts the heart pounding and the blood rushing. DX has always been a pinnacle of amateur radio; the peak toward which many hams climb throughout their amateur career. And now, thanks to Novice Enhancement and increasing sunspot numbers, DX is well within the reach of every Novice and Technician.

Ten meters is one of the most fascinating DX bands. Even simple antennas and low-power stations can talk around the world on 10 meters when the band is right. Today's Novices have probably heard how hot this band was during the last sunspot peak. At its best, DXing on 10 meters is arm-chair easy, but even prime band conditions require some thought and skill. Ten meters is an excellent training ground for new DXers. Antenna and power requirements are not as great on this band as, say, on 20 meters. Stations are more spread out than on 20 meters, a real boon to the low-power station. So, let's see how to cash in on 10-meter SSB DX.

The Station

Any station capable of making a local contact can make a DX contact on 10-meter SSB. A little attention to detail, however, will greatly increase its DX-effectiveness.

Check out your rig. Many amateur transceivers exhibit a reduction in output power on 10 meters. Make sure your rig puts out the power it should. Next, check your microphone gain and processor level. A signal with poor audio quality might make local contacts, but in the DX pileups and over long radio paths, only the clearest audio penetrates. Find another ham at least a few miles away to listen to your signal. Gradually increase the mike gain until your signal stops increasing in strength. Any more gain and you're inviting distortion, and poor DXing. Do the same with the speech processor, if any. Increase its gain until the signal starts to distort, and then back it off. Judging by signals in DX pileups, many hams think they can get through better by turning up their mike gain. The opposite is true.

Once your rig is tuned up, check out your antenna system. Although any antenna will work for DX, the better the antenna, the more DX you will work. A rotatable beam antenna is best, and used CB yagis are often available. Trim 5" off each end of each element, wire in new coax, and put it on a TV rotator. A 10-meter dipole can also put out a good DX signal.

Whatever antenna you use, try to get it at least 30 feet in the air. For DX contacts, you want to keep the angle of radiation of your signal as low as possible, for maximum signal strength over long distances. Thus your horizontal antenna should be at least one-wavelength high, or about 30 feet at 10 meters. A TV push-up mast, carefully guyed, can support a small 10-meter yagi. A dipole should also be as high as possible, for the same reason.

> ***"Ten meters is one of the most fascinating DX bands."***

Vertical antennas concentrate much of their signal in low angles of radiation. Thus, a properly installed vertical, with radials, out in the clear, can be an excellent DX antenna. A 10-meter vertical is a space-saver at only about 8 feet tall.

Propagation

Once your station is ready, you need to figure out when to DX. Ten meters is a notoriously fickle DX band. It can be wide-open around the world at one time, and completely void of DX an hour later.

Fortunately, you can easily determine if 10 meters is open for long-haul DX contacts. Tune between 28,200 and 28,300 kHz and you'll hear a host of beacons in every corner of the globe that indicate band openings. The propagation charts and forecasts in the various amateur radio magazines will suggest good times to check 10 meters. Shortening skip on 15 meters is a sign that 10 is about to open. In other words, if stations near you are increasing in signal strength, check the next higher band for activity. You can also ask other amateurs on the band if any DX is coming through.

Even with low sunspot numbers, 10m often proves fruitful for north-south contacts. US hams should check for signals from the Caribbean and South America. Turn the beam south and tune across the entire band for signals, not just the Novice portion. Novices can work more than half way to DXCC or DX Dynasty with north-south contacts. Count how many countries there are in the Caribbean and South America!

The most reliable way to check 10 meters is to call CQ. Never give up on 10 meters after tuning quickly across the band and not hearing anything. Often 10 is open but, because everyone is listening and no one is transmitting, the band sounds dead. Try a series of short CQs in the direction of the sun before you quit. Not one long CQ, but a series of very short CQ DXs with ample listening between the series.

Listening, Listening

The single most important information piece of equipment for DX is a good ear. A successful DXer spends about 90% of his or her time receiving. Listen first to the whole band. Is it active? Are signal strengths good? Where is the activity concentrated? Then listen for individual DX callsigns. What country or part of the world are they from? The well-tuned ear can yield a great deal of intelligence about band conditions. The DXer then sets up a strategy to snag that rare one.

Once you have isolated a single DX station you wish to contact, listen carefully for his exact callsign, location, name, and QSL in

formation. Be sure to listen to both sides of the DX contact. Whenever you can hear both the US station and the DX station, you increase your chance of a successful DX QSO. Determine the exact frequency on which the US station is transmitting. This is more important than sending on the DX station's frequency. You want to transmit where the DX is listening.

Then listen to what kind of calls the DX station responds to. Is it the last callsign in the pileup? The first? The fastest? The best phonetics? If you can discern a pattern in the way the DX station responds, try that same technique and increase your chances for a successful contact.

You should also listen outside the 28,300–28,500 kHz range, especially in the DX segment from 28,500 to 28,600 kHz. The presence of US Novices will gradually pull many stations below 28,500, but meanwhile listen for DX signals above that frequency. If you hear some choice DX, ask a higher-class licensee to go up and ask the DX station to move down into the Novice subband. Many would be pleased to comply.

Logging and QSLs

Once you complete your contact with the DX station, you'll want to obtain a QSL card as a permanent memento of the contact and, more importantly, as proof of the QSO for the various DX awards. The first step toward confirming your DX contact is complete, accurate logging.

Although the FCC requires only a minimal log, a DXer soon learns the value of a comprehensive, detailed record of DX contacts. In addition to the obvious information of date, time, exact frequency (not simply band), name and QTH, the DXer will note overall band conditions, callsigns of station called but not worked (they may well be on the same frequency at the same time another day), the power and antennas of the DX stations (does it take a kilowatt and a large beam to produce a weak signal at your location?), and many other notes.

When you are lucky enough to work a station for a new country, you'll want to log even more information. To increase your chances of getting a return QSL, you might want to give the DX station a detailed description of band conditions and how his signal compared to others on the band at the same time. Observations such as, "Yours is the only signal from Middle East—Europe very loud," or "Loudest Caribbean on band," are useful to the DX stations.

"Whatever antenna you use, try to get it at least 30′ in the air."

Always keep your log in Coordinated Universal Time (UTC). DXers keep their shack clock on UTC and check it against WWV regularly. A DX station might fill a log page in 5 minutes. If the time on your QSL is more than a minute or two off, he might not find your contact. Some DX stations can draw huge pileups and work several stations a minute. An incorrect time on your QSL could put your contact several pages away from where it should be! And pay particular attention to the UTC date, which advances in early evening in the US. QSL managers consistently report that more than 20% of all the cards they receive have the wrong time or date.

The subject of confirming DX contacts can (and does) fill books. Many of the details of preparing the envelopes, using International Reply Coupons (IRCs) or Green Stamps (US $1 bill), and finding correct DX addresses has been published elsewhere. Two items sometimes overlooked by the new DXer are maintaining good records of your QSLs sent, and keeping envelopes at your incoming QSL bureau.

If you keep careful track of when, to whom, and how each QSL was mailed, you'll better be able to follow up lost cards. Again, you DX logbook is an excellent place to keep these records. You will undoubtedly start receiving QSL cards via the bureau system, some months after you start making DX contacts. Complete details on the free incoming bureau system are available from ARRL Headquarters in Newington for a self-addressed stamped envelope. Follow the simple rules about maintaining envelope or postage credits at your district bureau to speed bureau cards to you shack.

The 10-meter band will improve every month for the next few years, before conditions level off and start to decline in the early 1990s. The next year or two will be an exciting time to chase DX on 10 meters. Before you know it, you'll be a DXer.

How will you know that you've become a DXer? A DXer always knows exactly how many countries he or she has worked, and how many of them are confirmed. Once you start to count your countries, you're in the fraternity. Good DXing!

Chod Harris VP2ML has been licensed for 20 years and has written the DX column for us since 1983. Chod earned his first DXCC on 10 meters at the bottom of the last sunspot cycle. He publishes the DX Bulletin in Santa Rosa CA. His address is PO Box 4881, Santa Rosa CA 95402.

Ten Meter Beacons Live Here

Frequency	Callsign	QTH
28.050	PY2GOB	Sao Paulo
28.175	VE3TEN	Ottawa
28.195	IY4M	Bologna
28.200	GB3SX	Crowborough
28.200	KF4MS	St. Petersburg FL
28.2025	ZS5VHF	Natal
28.205	DLØIGI	Mt. Predigstuhl
28.2075	W8FKL	Venice FL
28.208	WA1IOB	Marlborough MA
28.210	3B8MS	Mauritius
28.210	K4KMZ	Elizabethtown KY
28.212	ZD9GI	Gough Island
28.215	GB3RAL	Slough
28.2175	B9YMY	Oklahoma City OK
28.220	5B4CY	Zyyi
28.222	W9UXO	Chicago IL
28.2225	HG2BHA	Tapolca
28.2275	EA6AU	Mallorca
28.230	ZL2MHF	Mt. Climie
28.232	W7JPI	Sonoita
28.2325	KD4EC	Jupiter FL
28.235	VP9BA	Southampton
28.2375	LA5TEN	Oslo
28.240	OA4CK	Lima
28.2405	5Z4ERR	Nairobi
28.2425	ZS1CTB	Capetown
28.245	A92C	Bahrain
28.2475	EA2HB	San Sebastian
28.248	K1BZ	Belfast ME
28.250	Z21ANB	Bulawayo
28.253	WB4JHS	Durham NC
28.255	LU1UG	General Pico
28.2575	DKØTE	Konstanz
28.260	VK5WI	Adelaide
28.262	VK6RSY	Dural
28.264	VK6RWA	Perth
28.266	VK6RTW	Albany
28.268	W9KFO	Eaton IN
28.270	ZS6PW	Pretoria
28.270	VK4RTL	Townsville
28.2725	9L1FTN	Freetown
28.275	AL7GQ	Jackson MS
28.2775	DFØAAB	Kiel
28.280	YV5AYV	Caracas
28.280	LU8EB	Tandil
28.285	VP8ADE	Adelaide Island
28.286	KA1YE	Henrietta NY
28.287	H44SI	Honiara
28.287	W8OMV	Ashville NC
28.288	W2NZH	Moorestown NJ
28.290	VS6TEN	Mt. Matilda
28.2925	LU2FFV	San Jorge
28.299	PY2AMI	Sao Paulo
28.315	ZS1LA	Still Bay
28.888	W6IRT	North Hollywood A
28.890	WD9GOE	Freeburg IL
28.992	DLØNF	Nuernberg

QRP

Number 39 on your Feedback card

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

6L6 SPECIAL UPDATE

As promised, here's the 6L6 special update. It started out as just a weekend project to satisfy Father Radio that I really could build something with a tube in it, and ended up firing up a lot of QRP operators. I'm still getting letters from the column in the May 87 issue of *73 Magazine*. I saved some of them for the update.

Many people wrote about the screen circuit. The way I generate the screen voltage saves me the trouble of using a separate screen supply. The 1938 *QST* article by Fred Sutter W8QBW used a separate screen supply. Richard Bell WA4BNO sent in the screen circuit shown in Figure 1. Notice that he is running 300 volts on the plate. My power supply had a bit more kick, and if your plate supply is also higher than the 300 volts Richard uses, you may want to fudge the resistor values a bit.

What's this? You don't have 50-kΩ, 10-Watt resistors? Well neither did I, and I didn't want to make a pest of myself at Father Radio's house. ALL Electronics has a very good selection of high-watt resistors at very low prices. If they don't have just what you need, you can always mix and match using Ohm's law to calculate the values.

Cathode Keying

The keying method of the 6L6 Special—cathode keying—is very old and very basic. You ground the cathode of the tube and the tube conducts. If you're having a bit of trouble keying the rig, increase the capacitor on the key line from .01 to .02. You can also add a resistor in series with the cathode. Try 100 Ohms at 12 Watts or so. I'm sorry to say you can't use your fancy hi-tech electronic keyer with the 6L6, since the switching transistor will not survive the current nor the high voltage that is present on the cathode of the 6L6.

This leaves only three ways to key the transmitter. You can use the old straight key and not worry about the trouble. You can also use a Vibroplex bug. (I never could master one of those things. My CW came out sounding like someone was choking a drunk monkey!) You can also try special transistor switching.

Finally, there's relay keying. Figure 2 shows a circuit that *should* work with the 6L6 Special, but I haven't yet tried it. The circuit is very simple. The heart of the circuit is the horizontal output transistor, which withstands high voltages and can switch several amps of current. This is a slightly modified version of a basic circuit from the *ARRL Handbook*. When you ground the base of the 2N2905, you turn on Q2. Q2 then grounds the cathode of the tube. The resistors and capacitor in Q2's base will shape the wave. You will have to experiment with the values for the best looking wave. You do have a 'scope, don't you?

Radio Shack sells a replacement horizontal output transistor, but it goes for about $8. Look for one in surplus or at a hamfest and buy several for the junk box.

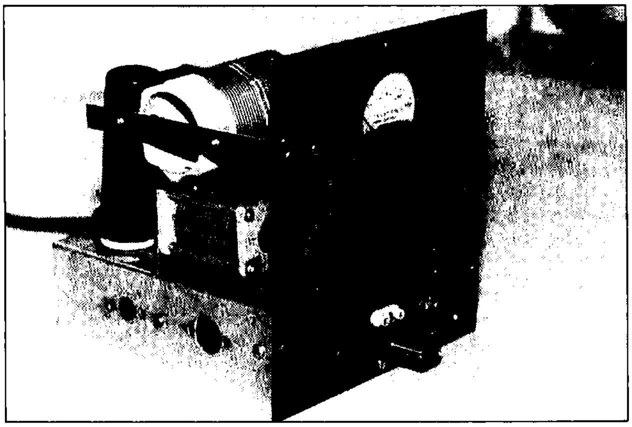
You can use a heavy-duty relay to key the transmitter. The drawbacks here are that these relays can't follow high-speed CW coming from your electronic keyer, and they are really noisy. I solved this problem many years ago when I came across a mercury-wetted relay. I use it to key one of my home-brew transmitters that also used cathode keying. The relay will switch anything! You might also find one of these rooting around atsurplus houses and hamfests, and in junk boxes.

This particular relay has a 12-volt coil, so I built up a circuit that looks like the one in Figure 2. I just replaced the tube with the relay coil and removed the RC network. When you ground the keyline, the relay pulls in, which in turns grounds the cathode of the tube. This method is how I have been keying my version of the 6L6 Special. Here I connected my relay driver to my Color Computer for computer-generated code!

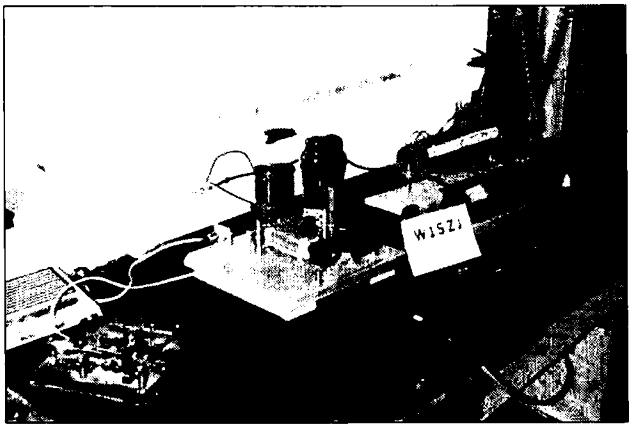
One more question about the keying of the rig: what about sidetone? I just use the built-in tone on my home-brew keyer. The Color Computer will also generate its own sidetone. I have seen circuits that will generate a sidetone by sampling the RF from the transmitter and they generate a tone, but I've never been much impressed by them.

A lot of builders wrote to say they changed from the PI-output back over to the link output. That's fine with me. Most of you did, however, use a plug-in coil set up to change bands.

Remember, you are working with an oscillator. Several builders have written to me about yoopy-sounding tones. Remember here to not load the tube for maximum output. Listen to your tone as you tune up. You will notice the tone of the CW



The 6L6 Special, built by Arliss W7XU.



Dave W1SZJ's version.

John W1YUZ's version.

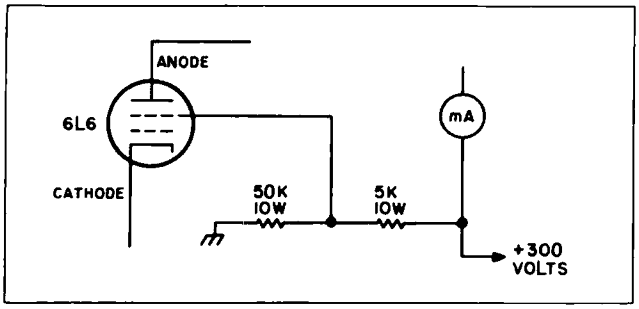


Fig. 1. Different screen circuit for use with the 6L6 Special.

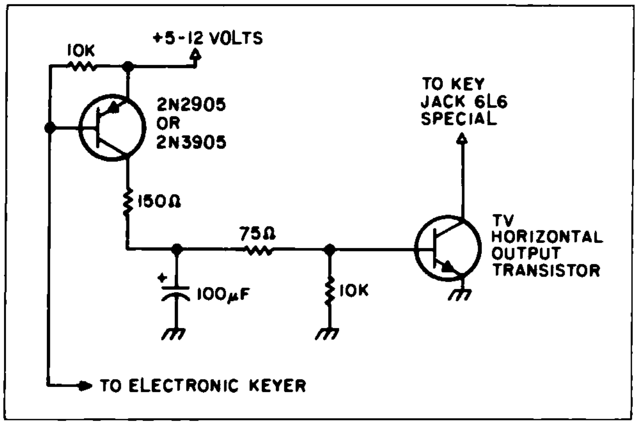


Fig. 2. For interfacing with an electronic keyer, try this circuit.

change as you load, and peak the 6L6. Go for the best-sounding CW note instead of maximum power output. Old sluggish crystals will also give a bad CW tone—try newer rocks.

A Bit of Sharing

Some of you have asked about setting up a special frequency for the 6L6 Special. Let's try the QRP calling frequency of 7.040, Jan Crystals sell the FT-243 crystals for about $2.50 each.

That should take care of most of the questions that have come up on the 6L6 Special. Now as promised, some of your handywork. Who says hams don't build anymore?—check out the QRP operators.

Arliss Thompson W7XU sent in a photo of his 6L6 Special (Photo A). Arliss uses the metal version of the tube. He notes that "the holes in the side of the chassis are from some long- (and probably best-) forgotten project." The transmitter was removed from its box for the photo. A fine job, Arliss!

John Ormsbee W1YUZ built his version using the old breadboard design. The PI-network features a B & W plug-in coil for 40 meters. Two 6L6s are used, one for the oscillator and the second for the amplifier. There's 300 Volts on the plate of the final, and it puts out about 8–9 Watts. With that BC-348-K receiver, that's quite a station.

Dave W1SZJ also built his 6L6 Special on a piece of wood. The "L"-tuner, 135-foot wire, and 8-Watt output from the transmitter pack a good punch.

Everyone built their version using what they had. I wish I had the time to build some of the versions sent to me! Most use a separate oscillator, buffer, and then a 6L6 for the final. The 6AG7 seems to be the tube of choice for the oscillator. Some of the circuits even include grid-block keying and special regulated power supplies, complete with the regulated screen supply. Not bad for a 50-year-old idea!

Odds N' Ends Dept.

By the time this column hits your mailbox, Paula Franke WB9TBU will be the new editor for the QRP ARCI publication, the *QRP Quarterly*. Paula will be looking for articles for the *Quarterly*. She works with IBM-PCs and can work with WordStar™, WordPerfect™, and Microsoft Word™ word-processing programs. In addition, she can read ASCII files, which saves an enormous amount of time keyboarding text. Articles on all aspects of low-power communications are welcome.

Serious QRPers should consider joining the QRP ARCI. New memberships are $12, and renewals are $10. Send your check or money order to Membership Chairman Bill Harding K4AHK, 10923 Carters Oak Way, Burke VA 22015.

"Go for the best-sounding CW note instead of maximum power output."

This year marks the 10th anniversary of the Michigan QRP Club. Their 8th Annual CW contest starts on January 16, at 1200Z, and runs through January 17 at 2359Z. This is 36 hours of CW-only contesting on 160 through 10 meters, excluding the WARC bands. The contest is open to all amateurs and all are eligible for awards.

The exchange is as follows: RST, QTH, M-QRP Membership number (non-members send power output). There are three classes of operation with bonus points for power output and for battery/natural power. For more information about the contest, please send a large SASE to L.T. Switzer N8CQA, 654 Georgia, Marysville MI 48040. A set of log sheets and one entry form are available for a SASE to K8DD, 1640 Henry, Port Huron MI 48060.

While I don't have all the details, the Michigan group plans many anniversary specials. Now would be a good time to help the club with your membership!

One last item. The antenna special sure got a lot of people upset about my stand with the vertical antenna. (One guy even sent me a dead spider in the mail!) I also offered all those who wrote to say I don't know a thing about vertical antennas the chance to tell the world via the QRP column. I received many letters about vertical antennas, but the one Skip WB8OWM sent to me says it all:

"I take exception to your views on the HW-7 and vertical antennas. I've managed to work over a hundred countries with my K-Mart lantern-battery-powered HW-7 and vertical antenna. The gods of Newington for some reason continue to mount their verticals on the ground. Perhaps they're confused about "low angle of radiation."... "Over the years I have learned through experience that our hobby is full of French words. For example, QUAD. Quad is French for 'comes down in winter.' BALUN is another French word. BALUN means 'RF transformer/ RF loss.' I'd say at least .2 db of loss. That's why I use a Budwig center insulator—no loss. It's also a waterproof way of connecting the coax to any dipole."

Like most of the others who wrote to me about the vertical, Skip also wrote to say that the verticals will work best if mounted out of the way of buildings, trees, and other objects. Radials from a tower-mounted vertical will add extra kick to the antenna. Perhaps there is enough information that needs to be shared on this subject that I should devote a month just to the vertical antenna. Please, no more dead spiders!

Two-Fer Errata

Several bits of information were dropped on the November column about the Two-Fer. For those who want a circuit board or semi-kit, the parts placement guide, or if you have any other questions about the column, drop me a line with a SASE.

There were also a few errors. Reverse the 80- and 20-meter coil values for the filter. The schematic shows a MFP102; it should read MPF102. Also, the capacitor on the 12-Volt supply for the PA transistor is 10 instead of 18 µF. As well, the resistor on the base of the PA transistor is 33Ω, not 93Ω.

Next month look for the QRP 5'er. And no, it's not what you think. There will be some good reading coming down the pike this year here in the QRP column!

OP-ED

by Larry Ledlow, Jr. NA5E

Modern Mythology and Amateur Radio

I've had an interest in radio for as long as I can remember. Radio listening became my main hobby twenty years ago, and eventually the ham bug bit me very hard. Radio has usually figured heavily in a lot of big decisions in my life. Radio physics and astronomy kept my interest up through college, and I pursued a very successful career in radio science with Uncle Sam before I came to *73*. Amateur radio, though, has provided most of the truly rewarding experiences in my life through intellectual stimulation, the satisfaction of serving the public, and a sense of international, fraternal order.

There are plenty of folks pitching *status quo*, a dangerous idea that promotes complacency and therefore guarantees amateur radio a mediocre place in the history books. At the same time, soothsayers of gloom and doom would have us believe ham radio is all but washed up in a technological torrent that has left us far behind the power curve in advancing radio state-of-the-art. I have serious misgivings about these two extreme views, which both stand firmly on certain mythical ideas about amateur radio.

Fallacies Abound

Myth number one: *There exists a generally accepted definition of "average ham."* Think about how silly this idea really is. There are more than 1.5 million amateur radio operators in the world. They come from all walks of life, speak hundreds of different languages, and have an enormously wide variety of interests, both related and unrelated to radio. Now, you tell me who, out of all those people, is an "average" ham.

First of all, I don't know anyone who wants to be average. That aside, to assume there is an average ham, even in our collective imagination, who fairly represents the entire amateur radio operator population is. . . well, silly! That's like saying there is an average snow flake. Sure, you can make some accurate statements about snow flakes in general. They're white, six-sided water crystals, but try to define an *average* snow

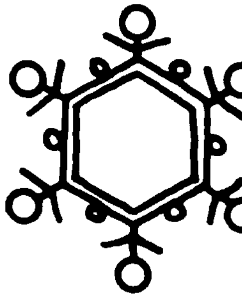


Fig. 1 Generic Snow Flake

flake. You can make a lot of sweeping statements about hams, but don't *ever* tell me you've managed to define the average ham.

Could we say the average ham is Japanese, owns 2.675 radios, drives a Toyota, and only operates 2.347 hours per week on 40-meter RTTY? Nope, and we couldn't say anything else meaningful about our mythical average ham.

Oversimplification of a problem—in this case, defining the average ham—is the first step to the wrong conclusion. We must recognize the amateur radio population at large as an incredibly diverse group, whose only true, common interest is radio. Any attempt to boil down hams' interests and abilities into just a few words is pure, unadulterated fallacy. If you agree there is not an average ham, then immediately all the prophetic statements about ham radio that use the term become invalid and meaningless.

Something New, Something Old

This brings us to myth number two: *Amateur radio offers nothing new.* If you haven't done something before, then it's new. Therefore, ham radio holds plenty of new adventures for most of us. There aren't too many hams around who have done it all and seen it all. The challenge of a new mode or band can be inspirational.

Back when unlicensed, shortwave listening (SWLing) was the only game I played, I always got a thrill when I heard a new country or a rare broadcast station. I still get a kick when I work a new country on the ham bands, but I find a lot of joy trying out communication modes that are new to me. KA1HY and I recently made our first contacts on the Russian RS-10 and -11 satellites. Great fun! Both of us relished our triumph, and we celebrated with pizza and beer. Cynics may point out that a satellite contact these days rates pretty low on the universal scale of novelty. I would argue that fun and education are on the bottom line. Bryan and I had fun and learned something new.

New modes and construction projects are two obvious ways to spice up your ham life. How about folding your other interests into ham radio? Start or join a net with others interested in scuba diving, ballooning, gemology, foreign lan-

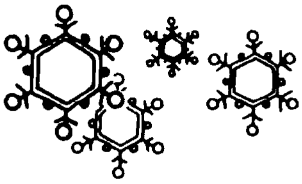


Fig. 2 Snow Flurries

guages, or anything else you want to learn or talk about. Remember how we dispelled myth number one. Hams are a big group with lots of interests represented. Getting on the air is a lot like going to a party. Eventually you run into someone you'd like to spend more time with.

I carry this argument further by debunking the corollary to amateur radio myth number two: *Ham radio offers little, if anything, for "outsiders."* Wrong again. This hobby suffers in part from bad (or incomplete) press. I maintain that because hams are such a diverse group, just about anyone can find something appealing about the hobby.

However, I can see why the local volunteer firemen can't muster a lot of enthusiasm for ham radio after listening to a discussion on amateur satellites or DXpeditions. On the other hand, they might find a demonstration of the regional repeater network interesting. Even a few pointers on mobile or handheld antennas might raise some eyebrows in the crowd.

Try to pitch packet radio to the local photography club. Yawn. I'll bet the shutter bugs' ears really perk up when you talk about trading snaps with hams all over the world with slow scan TV, though. Mention Tony England's SSTV effort from the Space Shuttle. Now *that's* interesting. . . to the photo club, anyway. Go ahead and pick a group of people to sell on ham radio. With a little thought, you can find an angle to get thementhused about this fantastic hobby.

We hams are guilty of not properly promoting the hobby to nonhams, but that doesn't mean amateur radio fails to offer anything new and exciting for newcomers.

Growing Pains

With all the new hams you'll recruit from other groups, we need to examine myth number three. *Bigger is better.* Not necessarily. A bigger ham population is not the sole prerequisite to a healthy state of the hobby. We need to emphasize quantity *and* quality. A larger ham population brings with it incipient problems like crowded bands and difficult rule enforcement.

We must dispel arrogant notions like operation on 20 meter SSB is a god-given right or that one mode or operating method is more righteous than another. Such ideas simply foster disorganization and counterproductive, if not destructive, acts on and off the airwaves.

We need to encourage newcomers to accept the responsibilities that come with a license and to realize cooperation is the only way to keep the hobby away from bedlam. No, I don't believe in an idyllic, tranquil state for amateur radio either. But constructive criticism and active debate are a far cry from name calling and frequency jamming. Bigger *can be* better, but we have to make it that way.

A Fresh Approach

There are plenty more myths to sweep away. I argue that the myths have polarized the hobby to a great extent. As a result, hams spend so much effort trying to overcome opposing views that amateur radio's progress is retarded. Arrogance, elitism, and self-serving cliques have no place in a hobby that supposedly promotes goodwill amongst fellow human beings (not just the hobbyists).

All is not well with amateur radio, but then all is not bad either. It's time we quit picking sides as if we were going to a tug of war and decided to work together for a change. Esprit de corps, lively debate, and, above all, mutual respect are key ingredients to successful teamwork.

Let's take a deliberate look back, learn from both our triumphs and failures. Then let's chart our course for the future with knowledge, vigor, and optimism. . . and without mythology.

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Welcome, Newcomers!

What is QRP?

Amateur radio lingo is full of abbreviations and code words, many of which have evolved from the days of CW (Morse code)-only communications. (Check the glossary for definitions of unfamiliar words printed in bold type below.)

A lot of common and relevant statements and questions have been reduced to three-letter statements/questions beginning with "Q." Many words and phrases have also been abbreviated into procedural signals, or prosigns. This made CW communications much more efficient. *Very* few of us can send CW at the rate (words per minute) that we can speak. See the December 1986 Newcomer's column for a more complete list of these signals.

Literally, QRP means "Reduce you power." Hams who enjoy low-power operation became known as QRPers. The unoffical maximum ORP power level is set at less than five or ten watts, depending on whom you ask. One watt or less of power out is called QRPp operation.

Many hams at first say, "What's the point in QRP operation?" Mayhem often reigns on the bands during periods of good **propagation**, with some hams running a full gallon-plus battling it out. "How can the little gun hope to compete?" "Why would anyone *want* to be a little gun?"

To be sure, there are reluctant QRPers—hams who make do with the equipment they have until they scrimp and save enough to run out and buy a 100-watt output rig or a **linear amp**. QRP has a large and devoted following, however. There's obviously much more to QRP than first meets the ear, as this issue will attempt to explain.

The Elegance of QRP

A QRP station can be very small—there are QRP transceivers that can fit in the palm of your hand! QRP can be much simpler devices than higher-powered rigs since there are fewer stages of circuits in the rig to step up the power of the signal and ensure the **linearity** and **purity** of its output signal. One- or two-afternoon QRP transceiver projects abound—Mike Bryce's QRP column is full of 'em. For hams who actually want to *apply* the electronic theory they learned (or memorized) for their exam, building a QRP rig is a great place to start—very little can match the thrill of making a DX contact on a piece of equipment that you've built yourself!

Now, you've built your pocket-sized, five watt rig on Friday night and Saturday and hanker to get on the air on Sunday. You know, however, that when propagation is good, the bands are often wall-to-wall booming signals.

What to do?

Craft Instead of Kilowatts

QRPers have to be a tenacious breed, but they soon learn that power out is not the only factor in making a contact. They bag many of their contacts when a particular band just opens up, before most other hams become aware of it. This doesn't mean that QRPers sit by their rigs 24 hours a day—band openings for many bands are predictable. A QRPer soon becomes skilled in the science of propagation.

The science is far from exact. There are unpredictable bands. Ten meters is often closed, especially during low sunspot activity, but can open up very suddenly at different times of the day. This band needs more monitoring, but then the chances are better that fewer people become aware of its opening, and the QRPer has a longer opportunity to work DX. When propagation is good, a *milliwatt* transmitter can still get a good report from a DX station. Read the DX Handy review by Mike Bryce and Chod Harris' DX column in this issue for more info on 10 meters.

A Little Antenna Math

A good high-gain antenna system greatly enhances the QRPer's chance of getting through to a contact.

What does gain mean? Gain is simply a *ratio*, usually expressed in decibels (dB), of a given antenna's effectiveness to direct signals toward or receive signals from a given direction. Gain measurements are made with respect to reference antennas, usually a theoretical **isotropic radiator**, a quarterwave vertical or a dipole. Gain is always measured with respect to *something* at a given frequency. A gain measurement made with respect to a dipole would have a "d" tacked on the end. A 6 dBd gain measurement indicates the antenna will improve signal strength in a given direction on a specific frequency four times (6 dB) over what a dipole would provide.

A high gain antenna is also very directive; that is, it tends to concentrate most of the radiation in a specific direction. Hence, antennas can increase the effective radiated power (ERP) of a transmitter. An antenna with 10 dBi maximum gain—the "i" shows the reference antenna is an isotrope—will generate a signal strength ten times greater at a receiver downrange from the main beam than an istoropic antenna using the same power. In other words, ten watts to a 10 dBi antenna will generate the same signal strength as 100 watts to the reference antenna; hence the term *effective* radiated power.

Can 100 watts ERP effectively compete with the rest of hamdom? You betl Many hams live in areas that restrict antenna systems. A city lot may not provide enough space for more than simple dipoles or verticals. Most hams don't run more than 100 watts, because linear amplifiers are too pricey.

You can see a QRPer with a good antenna system is really in the running!

Hats Off to QRPers

The finest point of QRP operation is that its pursuit forces the ham to *think*. He has to experiment with his equipment—installing narrow filters, improving antennas—and leam about propagation. The QRPer avoids the all-too-easy solution of cranking up the power to get through the crowds, which very easily leads to crowding out others. He shows courtesy to his fellow hams by almost never running more power out than necessary to conduct a contact (which is, incidentally, an FCC rule!). This is what separates the QRPers, who practice two critical mandates of the hobby—that of advancing the state of the art and fraternal goodwill—from the emerging throng of operators who treat the linear amp as a cure-all.

Enjoy this QRP issue. Let us hear from you!

...de KA1HY

GLOSSARY

DX Abbreviation for Long Distance. DX for the HF bands is typically anywhere out of North America.

Full-gallon Ham jargon for a kilowatt of output power.

HF High Frequency. Refers to the 160–10-meter (1.8 kHz–30 MHz) bands.

Isotropic Radiator A theoretical antenna that radiates equally in all directions.

Linear Amp Short for linear amplifier. This device takes an input signal and increases its power without (ideally) changing any other of its characteristics.

Linearity An expression of the resemblance between the input an output signals of a circuit. The better the linearity of a circuit, the less it distorts a signal.

Open up Ham jargon meaning "show good propagation." Refers to bands.

Propagation The transfer of energy (in this case, electro-magnetic energy) through medium or through space.

Purity Most often an expression relating the power of the fundamental frequency of a signal and the power of its non-fundamental frequencies, such as harmonics. The purer a signal, the more pronounced its fundamental relative to its non- fundamentals.

Editorial Offices
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603-525-4201

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73 AMATEUR RADIO®

FEBRUARY 1988 — Issue # 329

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FEEDBACK... FEEDBACK! It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 72. You'll notice a feedback card number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to 73.

Cover photo by Karen Greene: Steven Roberts KA8OVA and Maggie Victor KA8ZYW (story on page 11) relax on Sullivan's Island off the coast of South Carolina.

Number 2 on your Feedback card

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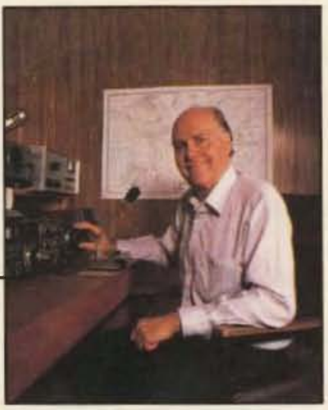

The Index

We've all been hearing and reading about the vaunted Information Age. Sadly, it hasn't had much effect on amateur radio so far. Indeed, other than for repeaters, incredibly little about amateur radio has changed for 99% of us in the last 30 years.

The biggest changes have been coming at us at work where most of us have to cope with telephone switching systems which are daunting. Many of us are doing well if we can remember 10% of the possible functions. Western Union and Postal Telegraph are now almost forgotten, as our businesses demand that we be comfortable with facsimile, telephone bulletin boards, Compuserve, The Source, MCI and local area computer networks.

At home we're either making do with 100-channel cable or a backyard satellite dish system—a couple of VCRs—projection TV. Meanwhile, at the ham rig we're still grumbling about AM being blown away and hunching down with our 1935 speed key while our grand-kids bewilder us with their Macintosh computers.

I got to thinking about the Information Age. I subscribe to about 250 magazines, so I have a fair idea of what is going on with magazine publishing...and I haven't seen diddly changing in magazines to help me cope with the information explosion. If you think about it, magazines are our main source of information, yet once a magazine is read and shelved, it's almost impossible to find that information again.

A Tiny Fraction

Yes, we can remember a tiny fraction of what we read—1% recall after six months is phenomenal. Yes, the yearly indexes help us to find particular articles we may want to check out again. But the sad fact is that even if we save our back issues, over 99% of the information we may want to find a few months or years later is a bitch to locate.

It's no news flash to you that I write editorials. You may not know that in addition to 73 I also write 'em for Digital Audio every month—bi-monthly for the Green CD Guide—bi-monthly for WHAT CD?—for Selling CDs—for Compact DJ—and the Green Congressional Technology Newsletter. So, in addition to trade, technical and consumer magazines, I also rely a good deal on technical and reference books...books which have darned good indexes. So why not, I said to mysell, have an index for magazines just as we do in reference books?

An in-depth index to each issue of a magazine should greatly improve its value for reference. Suddenly 99% of the material would be easily found when wanted in the future. Each issue of 73 would then be similar to a volume of an ongoing encyclopedia of amateur radio.

The first step was to write a program that would automatically check through the text of each 73 issue and generate the index. David Torrey has done a fine job of this and the result is the index which started in the January issue. Check it out.

I'm hoping we'll be able to get our bulletin board up and running again so we'll be able to provide the monthly indexes for those wanting them. If there's enough of a demand we'll make it available on a floppy disk at the end of the year. At the least we'll be putting it out as a small reference booklet for each year.

Let me know what you think of the index. Please look it over and let me know how you think we can improve it. After all, it's there to make your issues of *73* more useful and valuable for you. Are we missing some subjects we should be cross-indexing?

Another Information Age Innovation

The second way I see for magazines to become more valu-

Continued on page 41

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRM

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QRX . . .

EDITED BY BRYAN HASTINGS KA1HY

Coordination Update

Another regional coordination body has been formed. In late October of last year, eight North Central repeater coordinators and councils met in Ohio to form the Great Lakes Coordination Conference. This action occurred in the wake of a regional coordination council formed among several northeastern area councils.

The creation of these two new regional entities means that most coordinators and councils east of the Mississippi River, and most of those in the Midwest, are now covered by umbrella coordination organizations. The western states lag in their efforts to coordinate coordination councils.

Up, Up and Away

The European Space Agency's satellite launches are so far on a smooth track. The Ariane V-20 Mission, the twentieth in the European Consortium's program, lifted off from its pad in Kourou in French Guiana without a hitch on November 21st, and deposited its payload into geosynchronous orbit 15 minutes later.

This success still leaves the launch date for V-22, with AMSAT Phase 3C satellite as part of its payload, set for early this year.

TVI Shoes

We may never stop marveling at the varied sources of RFI! The following appeared in Zimbabwe's Harare Herald.

Zimbabwe is a south central African nation, formerly called Rhodesia.

A strange source of TV and FM radio reception interference was discovered there. According to a spokesman for three leading footwear manufacturers, the TVI source was traced to the shoes worn by viewers and listeners!

The problem is confined to some shoes made during the last two years using hides from cattle and elephant that came from drought-stricken areas. Because of the lack of grass, the animals were forced to eat a certain type of weed that contained a large concentration of aluminum salts.

Acting as tiny transistors, the components of the contaminated hides interacted and set up static discharges on shoes that were worn in dry carpeted rooms. Viewers and listeners were forced to move their feet to stop the TVI.

The "radio shoes" came to light, the Harare Herald said, when a senior technical executive of one of the shoe companies was dancing to FM "Radio Three" in his living room. He was astounded when, as he moved back and forth, the FM radio interference level synchronized with his dancing. Discreet contact with other shoe companies confirmed his suspicions.

Cross-Satellite Contacts

G4COU recently made crosslink contacts with WA3ETD, according to G3IOR. On November 27th the pair hooked up via an AO-10-to-FO-12 link. The uplink to AO-10 was on 70cm, giving a downlink on 2m. That downlink was picked up by FO-12's Mode JA receiver and resulted in an FO-12 downlink at 70cm.

On the same day, Dave G4CUO heard Andy OK3AU through RS-11 and FO-12. The 2m downlink of RS-11 running Mode KT (15m up, 10m and 2m down) was picked up by FO-12's Mode JA receiver. Dave listened to Andy's on the FO-12's Mode JA 70cm downlink.

Satellite crosslinking has been done in 1975 between AO-6 and AO-7, and in 1986 Between AO-10 and FO-12.

SO1A

Naama SO1A has been on regularly from the Western Sahara. Listen for him on 28.315 MHz. He also holds skeds with EA2JG on 3.791 MHz.

The Eyes Have It

When 18-year-old Dennis Dugger emerged from a coma last January, he could neither walk nor talk. The only motion his paralyzed body permitted was eye-blinking.

Witnessing the helpless frustration that the motorcycle-accident victim felt in trying to communicate spurred an invention. The hospital administrator, Steve Shipley, and Dennis' ham father developed a circuit that fits in a small box about the size of a cigarette pack. This circuit is wired to a small infrared light sensor that transforms eye-blinks into audible tones. The wire and sensor mounts on Dugger's glasses to detect reflected light off his eyelids.

Shipley had hung a chart of the Morse code next to Dugger's bed, who surprised everyone by learning the code in two days. Dugger was so eager to communicate that hams had to be called in to decode his rapid eye blinking. Shipley avers that the increased communication sped Dugger's recovery, because he could relate how he was feeling and so be helped. Dugger has recovered to the point where he can speak in a whisper and walk with crutches.

Shipley patented his device, which he calls Opticom, and is working on another model to translate eyeblinks into printed and voice-synthesized words.

70cm Threat

Canadian hams and hamsat users are concerned about the proposed installation of a one megawatt, 433 MHz windshear detector at Toronto's Pearson International Airport. The air safety device could seriously disrupt both terrestrial and satellite communications on 70cm. There are several other frequencies suitable for the detector, but the Canadian military has precluded their use. The CRRL has filed comments opposing the detector's use in the 70cm band.

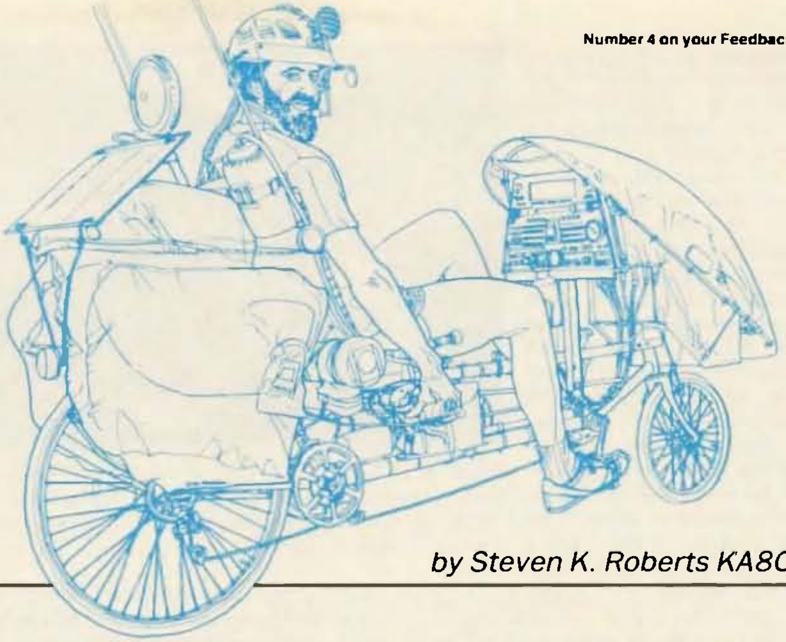
"10-Q"

To all who contributed news items this month. They are: Westlink, W5YI Report, CRRL Newsletter, CAREN's World, and the Daily Camera of Boulder, CO. Please send your news items, news photos, and other items of ham news interest to: 73 Magazine, 70 Rte. 202N, Peterborough NH 03458-1194; Attn: QRX.

The British Army's parachute team add a little excitement to GB4JUL operations last summer at a joint US-UK celebration of American Independence Day near Harrogate, North Yorkshire. Readers are reminded that the US does have a limited third party traffic agreement with British special event stations. The GB calls are issued without fee by the RSGB. Photo by G3DUW.

On the Road and On the Air

Tales of a High-Tech Nomad



by Steven K. Roberts KA8OVA

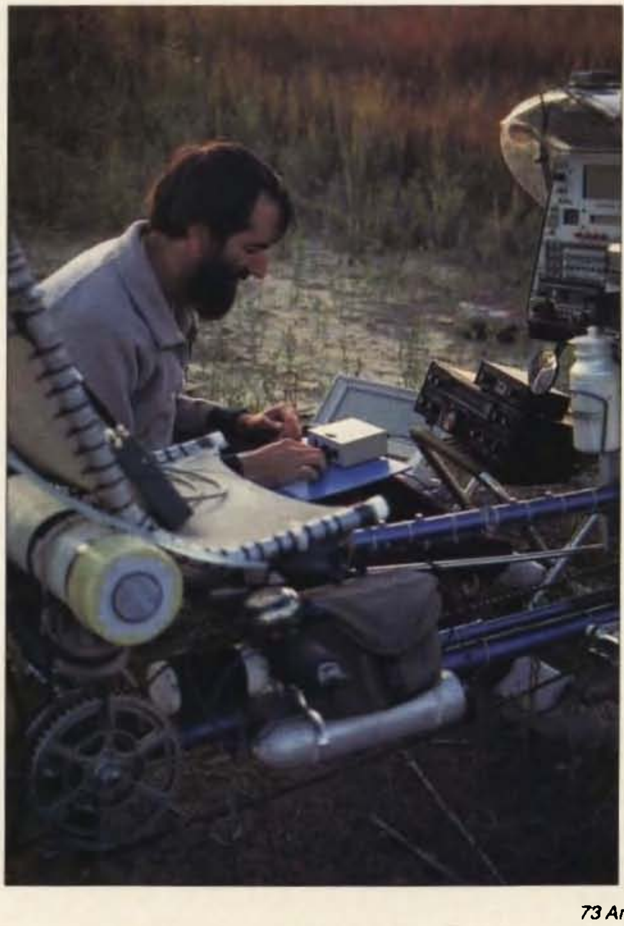
I think the dream started when I was a WN4 back in grade school: Someday I would wander the world on an electronic bicycle bedecked with radio gear and arcane instrumentation. It was a delightful fantasy, fueled by Carl & Jerry and the hobby rags of the day . . . but I'm sure I didn't really believe that as an adult I would live full-time on a pedal-powered solar ham shack with five computers and 1.7 megabytes of memory—or that I'd be able to digitally link cross-country via satellite while pedaling along a quiet country road. Like millions of other kids, I just had a passion for knobs, switches, and bikes.

But twenty years later in the spring of 1983, chained to a suburban desk in Genericsville, USA, it suddenly occurred to me that my old fantasy was ripening—that the tools becoming available could actually allow me to maintain a freelance-writing and consulting business while traveling full time. My product, after all, is information—and information has no mass. So why attach it to things that do? All I needed was a laptop computer, a network for data communications, a few watts of solar power, and a comfortable bicycle, robust and efficient enough to carry it all.

Driven by obsession, I set to work compressing my lifestyle into a rolling system of waterproof packs. Six months later, I pedaled away from Columbus into a new life of daily change . . . with all I owned either bungeed onto my 8-foot-long recumbent or connected to it via modem.

For nearly two years I traveled America, covering ten thousand miles in a freewheeling adventure that ranged from blazing passion to aching loneliness, from bizarre encounters to private moments of life-changing insight. Through it all, I kept writing on my H-P portable computer—yielding dozens of magazine articles and my fourth book (*Computing Across America—The Bicycle Odyssey of a High-tech Nomad*). It was indeed the fulfillment of my fantasy, but there were three big problems:

I grew tired of traveling alone.
I couldn't use the computer while riding.
I had no ham radio.



The Winnebiko II

During a one-year layover, both supported and motivated to hit the road by a real *job*, I completely rebuilt the Winnebiko . . . added extensive ham radio and computer equipment . . . and found a new girlfriend (Maggie KA8ZYW) willing to trash her lifestyle, get a ham license, and move to a bicycle. Life hasn't been the same since.

The system shown in the photos has been called a rolling caricature of the information age—it's a self-contained machine that has been my home and office for over 15,000 miles. Using a binary handlebar keyboard I can edit text, manage files, update the bike software, or even run a packet QSO while pedaling down the road. Twenty watts of solar modules charge 17 amp-hours of batteries, with a box of high-efficiency switching power supplies generating 5 subsidiary voltages. A security system can respond to motion by uttering a warning message through the speech synthesizer, setting off a siren, or paging me up to 3 miles away—and I can control many of the bike's functions via touch-tone commands from a 2-meter HT. A network of five CMOS microcomputers reconfigures itself on the fly to support the activity in progress. And the ham gear has grown to

include a pair of 2-meter rigs, a 10-meter handheld, a full HF QRP system, and a packet station complete with mailbox software for unattended operation.

A serious trade-off in any pedal-powered contrivance involves gravity, however, and the Winnebiko is heavily affected. Total system weight without my body is 275 pounds (which is one of the reasons for the 54-speed gearing system and disc brakes). Overall length including the trailer is about 12 feet—matched by the De Felice recumbent piloted by Maggie. Pedaling side-by-side, holding hands with our antenna-flags waving in the breeze and solar panels sparkling blue, we look for all the world like a rolling showpiece of alien technology.

Photo A. Called a rolling caricature of the information age, Steve Roberts' bike is a self-contained machine that has been his home and office for over 15,000 miles. (Photo courtesy of GEnie, General Electric Informaiton Services.)

So how does this system work? Why am I doing this? What's next? This article kicks off an article series by introducing the Winnebiko II from seven perspectives . . .

The Computers

The most celebrated feature of the bike from the media standpoint has always been its information-processing capability. The original motivation behind all this was the need to make intelligent business use of my pedaling time—for every 20,000 miles translates into about 2,000 hours (a full business year).

I have always carried a laptop, of course, and still do. The Hewlett-Packard Portable Plus is a robust MS-DOS machine with 1.2 megabytes of RAMdisk and all major applications software baked into ROM. . .and I carry a battery-powered 3.5-inch disk drive for archives. A daily routine involves hooking the HP to the nearest telephone and logging onto the GEnie™ network for my mail, with everything from reader responses to manuscripts routinely passing through my modem.

But however wonderful the 9-pound machine is when I'm in camp, it becomes a piece of high-tech luggage when I'm rolling. Somewhere in West Texas with a deadline on my tail, it abruptly occurred to me that I could vastly improve my effectiveness if I could only write while riding.

Capturing ideas on-the-road now involves two other computers. A Radio Shack Model 100, heavily modified, has been built into the control console, with its screen located at top center to minimize eye movement. The tiny 32K memory that came with the machine is now only workspace, for with Traveling Software's "Booster Pak" I have upgraded the lowly Model 100 to a quarter-megabyte of RAMdisk—plus extensive ROM software including an on-line dictionary, tree-structured operating system, database manager, and even a brisk asteroids game for arcade-style entertainment on those long desert highways.

But where's the keyboard? In the handlebars, of course! Eight waterproof buttons nestled on the underside of the grips comprise an efficient binary input device, with the feeling of typing comparable to playing a flute. A Motorola 68HC11 microprocessor (the bicycle control processor, or BCP) spends much of its time decoding and debouncing the handlebar inputs, mapping them onto the virtual switch matrix that the Model 100 still believes is attached to its keyboard port. A few 74HC chips complete the interface, waiting for the appropriate column strobe for each character and delivering the corresponding row codes.

When I'm on a roll with all this, I can type comfortably at 30 words per minute—about half my normal QWERTY speed.

The BCP has a number of other jobs as well (see Figure 1). It manages the communications among the other processors (including the packet TNC) by issuing control bits to a crossbar network of analog switches. In "remote mode," it responds to touch-tone commands received by the Yaesu 290—speaking to passers-by or performing security functions. It monitors system variables ranging from battery health to error conditions, and it determines the overall "flavor" of my interaction with the bike.

All in all, the architecture of this Grand Turing (o-less) Machine gives me maximum flexibility: the software simplicity of a multi-processor environment, a flexible hierarchy that supports ongoing expansion, and a battery-powered system that can be phased down to minimize current drain.

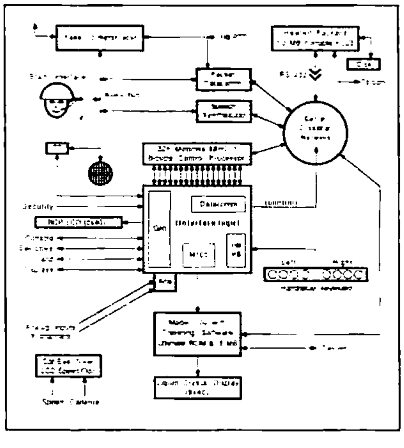


Fig. 1. The Winnebiko control system's internal architecture.

Bicycle-Mobile Packet

Perhaps the most entertaining confluence of digital reliability and radio black magic these days is packet, and it has become an essential component of my traveling circuits. There's something deliciously mad about playing NET/ROMulan while cranking hard through the hills of North Carolina, sending text through the satellite wormhole while causing miniature waves of future shock among passing locals.

On the practical side, my bicycle-mobile packet station has become an excellent door-opener in ham communities across the nation. I can sign onto a local PBBS from a hundred miles out of town or find myself in a live packet QSO while inbound. On many occasions, I have sent NTS traffic to new friends from the road, thanking them for their recent hospitality and letting them know we survived the City. And, of course, the growing packet mail network has become an important layer in the closest thing I have to a hometown: Dataspace.

The TNC on the bike is, of course, CMOS—the TNC-200 from Pac-Comm. With its LEDs remoted to the console and its on-board power supplies disabled, this product has been a trouble-free data communications link. And I have recently added custom Model 100 PBBS software with some unusual features. In addition to taking messages and paging me, this system offers short downloadable system descriptions, beacon management from the menu, and remote control or status-checking from a second TNC. Why a BBS on a bicycle? It's one of the best features of the system. I can now arrive in an unfamiliar town, initiate a beacon identfying the bicycle-mobile packet station, and stop for dinner—then emerge from the restaurant an hour later to find mail waiting on the bike from local packeteers! The welcome message explains enough about what we're doing to whet the appetite of *any* serious technoid.

But there's an interesting problem with all this mobile packet equipment. How can I have a stable network address while moving around the country? On-board PBBS or no, without constant juggling of everybody's forwarding tables and the White Pages, I'd have messages chasing me all over the US of A. Indeed, this is what was happening until recently—address management was getting to be such a nuisance that I was seriously considering limiting my packet activity to local contacts only.

But I now have a stable home BBS: the address is KA8OVA @ WA4ONG. Jim DeArras in Richmond is WA4ONG, and his

system is a very active 4-port BBS with Buckmaster's new online CD-ROM call directory. Any mail for KA8OVA or KA8ZYW gets forwarded into a local file, which is automatically transmitted to my mailbox (WORDY) on the GEnie™ network. While online, Jim's C program also forwards any mail from me into the packet gateway. The whole system is elegant and low-overhead—with packet messages simply showing up in my electronic IN-basket no matter where I happen to be. Ain't technology wonderful?

Incidentally, I don't need to sit on the bike and play the handlebar keyboard to run packet. A front-panel DB-9 accepts a cable to the HP, from which I can directly interact with any of the four console system processors. This is the mode I use when in the tent, beside the road, or parked in a host's garage.

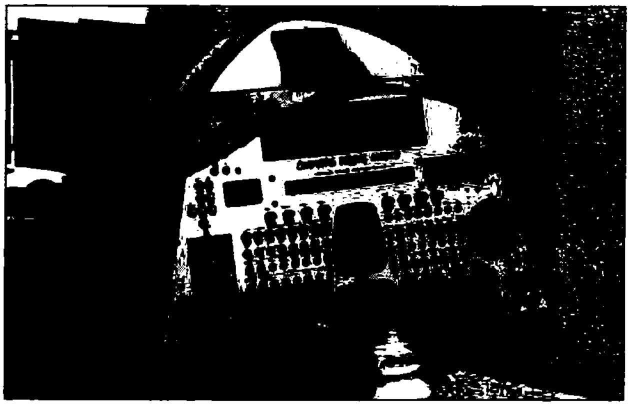


Photo B. A view of the Winnebiko's console. (Photo courtesy of GEnie, General Electric Information Services.)

2-Meter FM

It's very difficult to imagine how I ever traveled without 2-meter FM. Alone during that first 10,000 miles, I must have passed through the coverage areas of thousands of repeaters—vaguely sensing the electronic community swirling around me but never connecting. I seldom lacked company, of course, given the bizarre 2-wheeled door-opener sparkling beneath me, but those endless hours alone on the road...pedaling...pedaling.

A lot has changed. Built into the control console is Yaesu's new FT-290R multimode 2-meter rig—the ideal choice for this application. Every automotive transceiver I found was a power hog. Every handheld rig bristled with controls on all sides and was thus impossible to panel-mount. But the 290 is intended for portable operation (roughly 100 mA standby), it's smooth and easy to operate, and it lends itself well to console installation and interfacing.

Operation is easy. There is a Plantronics headset built into my bicycle helmet (the "brain interface unit"), and a push-to-talk switch in the left handlebar just under my thumb. For fixed operation, I simply plug in the standard Yaesu touch-tone mike.

Speaking of touch-tones, I have added an SSI-20C90 chip between the radio and the BCP. The telephone-grade pad shown in the console photo has always been a bit of a pain to use, so I have switched to software-controlled dialing. From the handlebar keys, a special command tells the processor to buffer a sequence, which is then transmitted to the radio upon receipt of termination code. Since repeaters differ widely in timing requirements, there is also a pass-through mode with an adjustable "software one-shot" on the PTT line.

The 20C90 chip receives touch-tones as well, and it is this feature that allows me to remote-control the bike through the Yaesu. From my HT, I transmit short command sequences which tell the BCP to do any of the following:

- Speak one of 32 pre-programmed utterances via the Votrax
- Sound the siren for N seconds
- Transmit local audio from the bike for N seconds
- Pipe received audio to the console speaker
- Turn yellow flasher on or off
- Enable/disable security system

The value of all this is most apparent in a "security" mode. When I'm away from the machine, I don't want to worry about what's going on around it. If my beeper sounds, I simply tell the bike to transmit 10 seconds of local audio, then select an appropriate speech string for it to say to the people standing around. "Do not touch, or you will be vaporized by a laser beam!" is a big favorite, as is: "Hi there, pretty girl. Would you like to ride on me?" If it becomes necessary to genuinely intimidate someone messing with the bike, I dispense with the cute stuff and instead trigger a 130-dB siren (which can also be set to happen automatically upon motion detection).

Maggie has a 2-meter rig on her machine as well—Yaesu's original 290, similarly installed on her front panel and powered by a solar-charged battery. We spend most of our on-the-road time on 145.52 simplex, and can honestly state that ham radio has saved our relationship: it's hard to imagine sharing a bicycle tour without some form of radio communications!

HF QRP

While 2-meter FM is a great tool for routine local conversation, it lacks the thrill and mystery of HF (Yes, you kilowatts out there, there really *is* mystery in the airwaves). I agonized over it for months and finally did it. My bike trailer now contains a Ten-Tec Argonaut 515 with all the attachments, a bag of dipoles and coax, a 4 amp-hour SAFT NiCd, and the new "DX Handy" 10-meter monobander from AEA.

Weight and power restrictions naturally constrain me to QRP operation, but it fits the whole spirit of a bicycle odyssey. In the first month of occasional use (which translates into getting on the air whenever I'm in one place long enough to finish urgent writing projects and throw a dipole in the trees), I worked Germany and 15 states—plus the Canary Islands on 10-meter sideband with the 2-watt AEA handheld. Have you ever really *thought* about this?

Well, think about it. You take some sliced rock, expose it to sunlight, store the resulting electrical current in a small box of chemicals—then shake it up to a few Megahertz, modulate it with your voice or wiggling fingers, and shove it out into a wire. Total power dissipated is about that of a penlight or small Christmas tree bulb.

Through a process that can best be described as magic (despite efforts to the contrary in textbooks), your signal disturbs a slice of the electromagnetic spectrum. Thousands of miles away, a stranger notices this and invokes a similar process to call you by name. Isn't this a bit wondrous? Somehow, doing it all with solar power and a bicycle-borne mini-station emphasizes the drama...for I've grown quite jaded with 99%-reliable network communications after 5 years of life in Dataspace. But chatting across the planet with a whisper of RF is an event worthy of celebration...and this highlights a major gap in the tools of our microculture:

How, exactly, do you express enthusiasm on CW? Working VE7BRR in 150 Mile House, British Columbia, on 2 watts from the East Coast one night, I was moved to exclaim my delight. *But there's no exclamation mark in the Morse code!* I propose that we fix that, at least informally, by adopting the new symbol WW (short for WOW), as the Morse exclamation point. Next time you find yourself about to default to the boring old "HI HI" when what you really mean is *hotdamn!* try didahdahdidahdah.

I suggest this as a reminder that underneath the technical gee-whiz and contact tallying there lies a human element—which translates into a major resource of friends and intelligent contacts around the world. Once we get past the Name, QTH, RST, RIG, ANT, and WX data, there's a lot to learn... unknown doors to open...and many new friends to be had.

But keeping track of all those people gets to be an interesting problem, especially when you live on a bicycle. One of the HP's jobs is to maintain my "hospitality database," a key resource for finding places to sleep. (The latest repeater directory helps, too, as do packet node lists.) But now I also carry a call directory of all US hams on microfiche, produced by Buckmaster Publishing. Three separate packs with a total of 27 4 x 6-inch fiches allow me to search by call, name, or city—a priceless resource in a venture such as this where the bottom line always seems to be measured in human terms.

So what's ahead for the bike's HF system? I'm about to have a go at mobile 10-meter CW operation—using the handlebar key-

board and the Model 100 to generate code and the console LCD to display incoming and outgoing text. With the sunspots coming around, things are going to get mighty strange in that band...

Solar Power System

"So how do you power that radio?" It's a common question on the local repeaters, but the answer goes far beyond the basic triad of photovoltaic modules, charge controllers, and batteries. My entire existence—entertainment, business, and road survival—depends upon a stable electrical power system.

A key word here is redundancy. There are two Solarex 10-watt photovoltaic modules charging a pair of 5-amp-hour lead-acid batteries (no NiCds here—the duty cycles are too random). One battery is dedicated to computers, and the other runs lights and the Yaesu 290. Console switches allow the panels to be swapped relative to the batteries—or the batteries to be swapped relative to the loads. This arrangement allows the computer battery to become a backup for the lights during long night rides...and it also lets me compensate for uneven illumination on the two panels since the rear PV module is almost fully shaded when I'm southbound this time of year. Charge management is handled by a trivial zener/check diode circuit.

Sometimes it's necessary to charge from the AC line, especially after extended rainy periods or marathon night rides. A dedicated LH Research switching power supply is built in, with console switches determining which battery gets to benefit from the power line. To eliminate a heavy current-limiter, I simply switch the mode of the headlight when charging the batteries from AC—putting it in series with the switcher. A soft glow tells me I'm getting about 400 mA.

The system described so far yields a pair of self-maintaining 12-volt bike system power buses, but there are a few other requirements. The HF rig, as mentioned, has its own NiCd (deep-cycling is appropriate here, unlike in the console). And the H P computer has about 2.5 amp-hours of lead-acid battery (25 hours worth), which can be fed solar current by a cable to the trailer or AC by a plug-in charger.

Subsidiary voltages—five of them—are produced by a small aluminum box of switching supplies, all running from 12 volts and switched in and out of micropower standby mode as needed. These are based on Linear Technologies LT-1070 chips running at about 50 kHz, and were created by Glenn Glassner of Columbus, Ohio. Producing up to 3 amps of 5 volts and 1 amp each of 3, 6, 9, and -12, this efficient unit takes care of all loads in the Winnebiko system.

I can monitor all this with an Acculex digital panel meter, a delightful little unit that requires absolutely no overhead and no noticeable supply current. You can see it in the control panel photo, displaying .28 amps of net charge current—along with a neighboring thumbwheel switch that feeds it any of the system power buses, the output of either LM10 charge current monitor, or the input from a front-panel test jack.

The bike's electrical loads are diverse. All voltages appear on front-panel jacks for accessories like the micro-TV or tent light—and various forms of charge current are likewise available to handle external batteries. The 5-volt supply is heavily filtered for the logic boards, the 6-volt supply runs the Model 100, and the 3-volt supply takes care of entertainment electronics. And the 12, well: it runs headlight, dimmable helmet/console light, tail light, red trailer flashers, yellow barricade flasher, siren, security system, 2-meter rig, an occasionally handy CB, and even a cooling fan for the greenhouse that exists between the dark blue forward solar panel and the clear Lexan™ fairing. Naturally, with all the potential for problems in this difficult mobile environment, all supplies are fused, switched, current-limited, and filtered.

Packaging and Maintenance

This is one of those issues that can take an otherwise solid design and quickly turn it into scrap. The Winnebiko II control system has withstood thousands of miles of heat, cold, vibration, potholes, crashes, condensation, lightning, static, human abuse, and most recently, a pickup-truck door in Whiteville, NC. Even when ragged Washington, DC, roads rattled my fillings and bent the unbendable 48-spoke undished wheel, the BCP kept on ticking, flashing its little green "OK" LED in blissful ignorance of the brutal pounding going on around it.

The entire console system unfolds for service, and can be removed from the bike by popping three toggle clamps, unplugging six waterproof Lemo connectors, and lifting straight up from the padded 70-75 aluminum support platforms. Years of industrial control system design taught me the value of equipment serviceability, for no matter how perfect a prototype may seem it is but a rough approximation of what it will someday become. That has certainly been the case here—bike control software is now at revision level 15.2, and my once-pristine documentation binder has been scarred by countless erasures, patches, afterthoughts, and TO-DO lists. No complex system is ever 100% complete...or correct.

With all this in mind, I built the system to support extensive diagnostics and development. Only rarely have actual repairs been necessary, but more times than I care to remember I have hunkered over the system in a campground with logic probe in hand, obsessed with getting the latest enhancement to work. Documentation is always a major issue, of course, so in addition to the paper binder of schematics I carry a miniature Keyan microfiche viewer with a large collection of IC databooks and system manuals on film. (And what high-tech bicycle would be complete without a robust "junkbag" of 74HC chips and tinkering stock?)

The control panel itself began life as a sheet of .090 aluminum, with the sides folded back and the corners TIG welded. I used a Bridgeport milling machine to cut the holes, and made press-fit abrasion-resistant Lexan™ windows to cover the LCDs. The unit was then bead-blasted and anodized, lettered with dry transfers through a two-step centering process and protected with 35 coats of Krylon, interspersed with five baking cycles.

So how does it stand the weather? On the road, a major issue is rain—which occurs very reliably whenever we camp or hit the road after a sunny indoor layover. The front panel can be protected with a clear Velcro-on cover that forms an effective seal with both fabric side curtains and the console aluminum itself. All this is under the fairing, and further steps have been taken to insure that no splashed or wheel-flung water can work its way up into the electronics. So far, the arrangement has kept the elements out of the system...and I often wish that my body could receive the same level of protection.

Fortunately, skin is highly water-resistant.

Life on the Road

Finally, let's take a quick look at the lifestyle that results from all this.

Thanks to communications systems ranging from computer networking to ham radio, it no longer matters where in the country we are. Business goes on. The term "wheeling and dealing" has taken on new meaning... and freelance writing no longer keeps me off the streets. As long as there's a little sunshine to charge my batteries, I have reliable human contact and computing power. As long as there's a phone line for the modem, I can run the company.

The net effect of all this is that "home" has become a three-part affair, a surprisingly tangible substrate for my nomadic existence. The most obvious component is our whole electronic cottage on wheels, of course—the 500-pound assemblage of tools, toys, and bicycles that keeps us going. Then there's America itself, a 3.5-million square mile neighborhood that we prowl slowly from season to season. And then, profoundly important but very hard to explain to the media, there is the multilayered network of human contacts—part Dataspace, part ham radio—that keeps the loneliness at bay.

You see, we never really leave home at all. It's inside us, around us, permeating our daily existence like water and sweat, fresh air and exhaust. The road has come to represent stability: a strange but deeply familiar blend of freedom and security. This is perhaps the greatest surprise of the journey—the discovery that change is an addiction and that the pleasure in new friendship never ends. With a bikeload of networking and ham radio gear, there will never be a shortage of either.

So I'll see you online...on the road...or on the air—and 73s from somewhere out there!

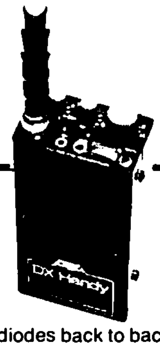
Steve Roberts can be reached at Computing Across America, 1013 Warren Ave., Cary NC 27511 (919/467-4806).

Number 5 on your Feedback card

73 Review *by Mike Bryce WB8VGE*

AEA DX 10m Handy Review

The world in the palm of your hand!



Advanced Electronic Applications
P.O. Box 2160
Lynnwood WA 98036
Price: $380

Over the years our handhelds have changed. They have gotten smaller and smaller with more bells and whistles than many larger HF rigs! I can even remember the Drake 22. Well, the DX Handy is a back-to-basics rig, using standard yet well thought-out circuits.

The DX Handy is a hand-held 28 MHz SSB transceiver with a QRP output of 2 watts. For those up to it, CW operation is possible with the built-in key. Operation frequency is crys tal-controlled, with a VXO giving each crystal about 50 kHz range. With ten meters coming back strong, and with the new Novice enhancements, the DX Handy is something else. Hand-held DX may seem far-fetched, but not with the DX Handy.

The rig does not have a PLL, hence no PLL noise or birdies in the receiver. In most PLL-controlled handhelds, the speaker will cause the PLL to modulate at an audio rate, causing a nasty howl. The handy obviously does not suffer from this problem.

Solid Quality

An attractive, light gray metal case houses the DX handy. There is a good, solid feel of quality in the radio. Unlike most handhelds, it has no belt clip. Even with the whip antenna fully collapsed, the antenna sticks up about a foot. It would be a real kidney-killer if worn on the belt.

Four screws retain the front case, which should make crystal changes easy. Nylon washers under each screw protect the case.

Even the new operator will find operation a snap. The radiohas basic features and nothing more: off, on, volume and station selector—that's about it! There's not even a squelch control.

The DX Handy uses a variable crystal oscillator, or VXO.

The VXO warps the crystal's frequency by 50 kHz. The DX Handy has a two-position switch for any two 50 kHz segments in the 28 to 29 MHz amateur band. Either of two crystals can switch in from the front panel selector.

Crystals supplied with the DX Handy will cover 28.250–28.300 and 28.300–28.350—the middle of the new Novice phone bands on ten meters! You can place the DX Handy anywhere in the ten-meter band with optional crystals. Since most of the activity will be in the Novice subbands, the DX Handy will appeal to the new Novice market.

This is a lot of radio for its size. Top controls include the main VXO and receiver incremental tuning (RIT) knobs, the band segment (crystal) select switch and volume control. The top panel also provides a dual purpose S- and RF output meter and jacks for an external speaker and microphone.

The spacing between the speaker and the mike jack looks very close to that which ICOM uses in their line of handhelds. The ICOM speaker/mike does plug right into the DX Handy, but it doesn't work. The DX Handy requires a three-circuit plug for the microphone connection.

The antenna connector is a standard BNC. AEA supplies a base-loaded whip and a 8' 3" counterpoise wire in the package.

Other less-used controls are located on the bottom of the unit. These include the battery test and mode switches, and charging jack. CW operators can use either the external key jack at the bottom or use the CW key built into the top of the radio.

The DX Handy comes with six standard AA carbon-zinc batteries. While it is a nice gesture from AEA, give the batteries to the kids and go purchase a good set of alkaline batteries.

On the Air

The receiver pops alive when installing the whip antenna with the radio turned on. With a 10m band opening a quick tune of the VXO will turn up stations from all over the country. The very stable VXO exhibits good linearity. Also, the smooth, detent-centered RIT control has a tuning range of ± 2.5 kHz.

Operation couldn't be simpler. Just extend the whip completely, tune in a station, push the side-mounted PTT button and talk. There is no microphone gain control to adjust. The red LED SEND indicator will light, and the RF output meter will deflect with the audio.

CW operation is a bit different. After proper band segment and mode selection, the operator must push the PTT button and key the radio, either by using the small push-button on the top, or an external keyer. In either case, the operator must keep the PTT button depressed. Also, AEA apparently overlooked the need to produce a CW sidetone.

At first I could not believe a handheld could produce such excellent receive audio. Several reports proved the excellence of the transmit audio, too. Most contacts did not believe I was using a hand-held radio.

Notice in Figure 1, the noise blanker is much more than two diodes back to back. The noise blanker works quite well on impulse noise like that produced by automobiles.

There is nothing like working someone with a watt or two. The DX Handy is no pileup cracker, and QRP operation is not push-button communications. The uniqueness of ten meter often produces surprising results. After weeks of quiet on the band, a good opening will prove the handy's two watts more than adequate to make most contacts.

A counterpoise wire greatly improves the performance of the whip antenna. The supplied wire attaches to a screw on the radio. A dipole, a quarter-wave vertical, or a small beam may help immensely, too.

The manual that comes with the DX Handy explains other operating hints as well as different antennas to use. The booklet contains much information about working and calling stations in the phone bands. This is aimed at the Novice user. The schematic of the DX Handy, however, is very hard on the eyes. Also, there were no troubleshooting guides, or any text on how the radio works.

Operators using NiCds in the DX Handy will use the charger plug on the bottom. Failure to turn the radio off and switch over to operate without unplugging the 12 volts will cook the radio. The dummy battery is a must when using alkaline batteries. AEA does effusively warn about this, and even includes two schematics of preregulators to build to prevent this from happening. To ease a lot of burden from both the end-user and the AEA service techs, AEA should have allowed for a built-in regulator to run the unit directly from a 12-volt source. Apparently, anything over 12 volts input will damage the unit and void the warranty. That's my one big complaint—the only other down points were no sidetone and an easier-on-the fingers PTT.

The proof of the pudding is that it works. My first QSO may not set records, but it sure was fun. I was standing in my backyard talking to N6AKO in California: Coast-to-coast S-9 communication with only two watts of RF, the whip antenna and the counterpoise wire! That, my friends, is a lot of fun; and that is what you can have with the DX Handy.

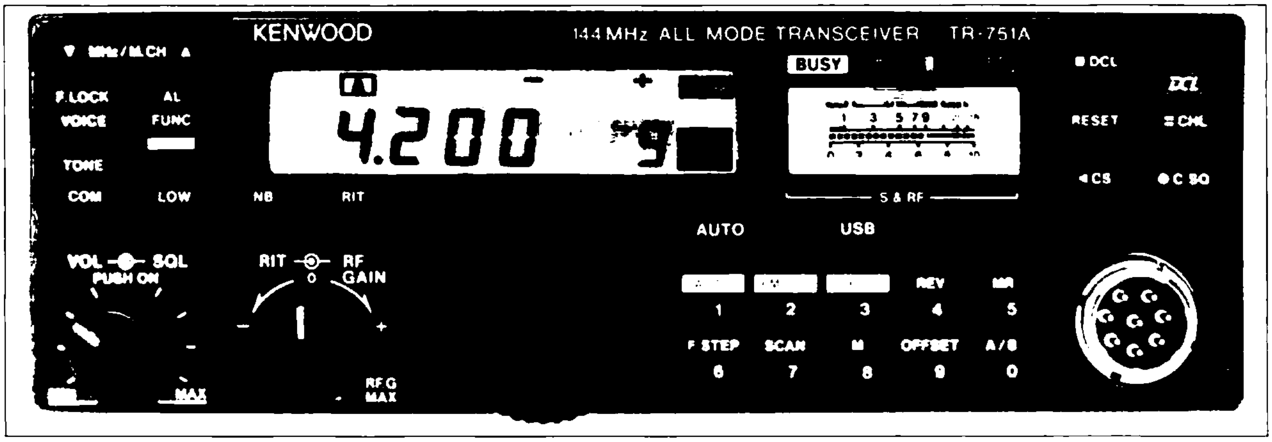
Number 6 on your Feedback card

73 Review *by Marc Stern, N1BLH*

Kenwood TR-751A Multi-mode VHF Transceiver

Kenwood USA Corporation
2201 E. Dominguez St.
Long Beach CA 90810
Price Class: $630

A standard for years to come.



An old saw claims that the more things change, the more they stay the same. It's only partly true for amateur radio. Radios still transmit and receive, and still use RF, but features of our radios have changed radically over the years.

Hams in the hobby more than five years will have seen HF rigs become synthesized, miniaturized, and microcomputer-controlled. HF rigs now have dual VFOs, built-in general coverage receivers, built-in narrow CW and SSB filtering, up to 100 memories, and the ability to be controlled by an external personal computer. There's even a rig—the Yaesu 767—that serves as the platform for not only a complete HF station, but also a fairly complete VHF/UHF station. An operator can add modules on it for 6 meters, 2 meters and 70 cm.

If this is the case for HF, imagine what's been happening at VHF and UHF.

Rigs have become incredibly compact and are still capable of 25 to 50 watts of output. VHF rigs have 10 to 20 memories and can have such items as built-in CTCSS tones for tone access, digitized voice, limited access, and liquid crystal displays.

Contrast this with one of the standards of a few years ago, the ICOM IC-255A. It was state of the art for 1980 and sported a microprocessor, light emitting diode display, dual VFOs, RIT, five memories, and high or low power. (All this is standard now.) It also had more than enough audio and was about as rugged a transceiver as we've run across in a long while.

However, the radio was big, on the order of about five pounds and measured in at about 6" x 8" x 2". Also, it didn't sport many of the features we take for granted today, such as repeater reverse, repeater offsets stored with frequency, priority channel, built-in CTCSS tones, and the ability to resume scanning after it had found a busy frequency.

The state of the art only seven years ago was far different than it is now.

Today's Technology

Let's return to today's state-of-the-art and look at one of the more capable multimode VHF rigs on the market, the Kenwood TR-751A. It is an example of just how far the radio art has come in less than a decade.

For starters, the TR-751A has a GaAsFET front end, something that was only dreamed about a few years ago. This development radically increases the sensitivity and dynamic range of the TR-751A. In fact, when I checked my TR-751A against one of the standbys of the 2-meter multimode world, the ICOM IC-251, we found that the 251 needed a preamp to match the performance of the TR-751A right out of the box.

Further, the TR-751A is far more linear in its operation. While tuning through a signal with the IC-251, the operator can hear the distinct frequency changes in the signal's beat note. It sounds not unlike a multi-tone commercial paging device. In contrast, the TR-751A tunes smoothly through the signal with no trace of a changing beat note.

Automatic QSY

Introduced last year, the TR-751A's built-in microcomputer programming has an interesting feature. When in the Channel Search (CS) mode, the TR-751A waits for a similarly equipped Kenwood with the same feature activated. Once it senses that it has connected with another Channel Search-equipped transceiver, the TR-751A synchronizes with the other unit and they both hunt for an open simplex frequency—presuming they are in simplex range, of course—and both rigs automatically QSY.

It's a great way to keep repeater use to a minimum, especially when the operators are capable of simplex operation. How many times have high-power VHF transceivers been used for repeater operation from fixed stations? It seems that more and more, repeaters are replacing simplex or 75 meters for local ragchewing, which isn't the purpose of repeaters in the first place. Repeaters are meant to allow reliable mobile communication when two mobile stations are out of sight of one another or for low-power station-to-station work when the radio's output can't be used for simplex work. Hams outside North America tend to appreciate this point much more.

Front Panel

The TR-751A uses a liquid crystal display (LCD). Much like a personal computer's CRT, the backlighted, green LCD displays frequency down to the nearest 50 Hz. It also indicates whether the operator has the alert feature activated; the frequency increments (50 Hz, 5 kHz, etc.): memory recall mode; the shift (plus, minus or simplex) for FM and repeater work; optionalsubaudible tone selection; and the frequency lockout. Further, the LCD indicates when it is in "open channel" search mode, and when the coded squelch option has been activated. The "open channel" search is one of the newest features of the Kenwood VHF lineup.

The LCD also has a standby mode indicator, which shows the features in that mode, an indication the TR-751A is in memory mode, where the memory number is indicated, and whether the RIT is activated.

The TR-751A's front panel is clean, easy to use and, sensibly arranged. All of the functions dealing with frequency are grouped in the upper left, while functions applying solely to radio operation are grouped below. In the center is a large frequency selection dial, while mode and memory buttons are grouped to the right.

The rig features a genuine analog S/RF meter that doubles as a relative power output meter. It's a refreshing change in these days of LED metering. Just above and below the S/RF meter are the status indicators, and pushbuttons dealing with coded squelch (Digital Code Squelch) and Digital Channel Link (DCL) are in the upper right. Altogether, it's a well done and well thought out front panel.

Automatic Mode Selection

This unique feature is one of the nicest on the TR-751A. Kenwood took the ARRL bandplan and put it into silicon memory. The result is that the rig does some thinking for the operator. The allotted mode is called up automatically at a spin of the dial. For example, in the automatic mode when tuned below 144.100, the CW indicator lights up; above 144.100, the USB indicator is lighted. In the repeater segment of the band, the FM indicator automatically lights. It makes this multi-mode rig a pleasure to use not only in contests (mine has seen more than one) as well as mobile. Let the radio worry about which mode and concentrate on logging or driving.

Other Bennies

The TR-751A also has more than enough punch for most situations. With a high-power setting of about 25 watts (it measured about 28 on my wattmeter) and a low-power setting of 5 watts, I found that it had more than enough power for mobile and contest work. I used a four-element beam and a short length of feedline so the effected radiated power of the lash-up was more than competitive with other stations. The high power setting will also drive most makes of high-power amps to 200 watts.

Another nice feature is the large, finned heatsink. The TR-751A provides more than enough heatsinking to operate at high power for hours with no problems.

The Receiver Incremental Tuning is also a very nice feature. It only works on receive, but when used in conjunction with 50 Hz resolution of the LCD, the operator can zero easily in on any station. On the down side, only a small indicator in the display indicates the RIT is activated. The receiver frequency remains the same and the transmit/receive frequency offset is not obvious.

On the air, the GaAsFET front end easily picks up weak stations and, even though the rig is very sensitive, it didn't complain in the presence of other RF signals. There was some increase in received noise, but it wasn't bothersome. A small adjustment of the RF gain control took care of overly-loud stations.

The noise blanker is also effective against most kinds of pulse-induced noise, such as ignition noise. It managed to quiet more than one noisy ignition when I was using it mobile. The transmit and receive audio are superb in both FM and SSB modes.

The only things I fault are the documentation and the price. At over $600 for the basic rig without the Tone Encoder or Voice options, it is quite expensive, especially for a single band multimode rig. The rig offers FM, sideband and CW, as well as DCL and a GaAsFET front end, but it's just as true that it's only for one band, rather than two. I suppose it's as much a result of the yen-dollar readjustment, which has made just about every imported item expensive.

Documentation

The documentation seems as if it were written by a person with little knowledge of the American idiom. It's rough and makes little sense in places. However, it does come through in the areas where it has to: programming and using the rig. The graphics are first quality and carry the user guide where the language falls down.

Overall, I enjoy using my TR-751A. It has some great specifications and quality features. And, like its predecessor, the TR-9130, the TR-751A should be a standard for many years to come.

Marc N1BLH is an engineer at Digital Electronics in Boston. He reviews regularly for 73 and may be reached at 555 Worcester Rd. Framingham MA 01701.

Number 7 on your Feedback card

73 Review *by Larry Ledlow, Jr. NA5E*

Mobile Commodore 64 Porta-Pow'r-Pak

Who says the C-64 isn't portable?

Ludvigson Electronics
415 N. Duiuth
Sioux Falls, SD 57104
Price Class: $80

Dave Ludvigson is a pretty clever guy. Commodore 64 users who could find uses for their computers in the field and on the road should love his latest offering. The Porta-Pow'r-Pak cuts those ties with the world of alternating current and allows the computer to go where the action is. Headed for foreign lands? The Porta-Pow'r-Pak is available for both American and European versions of the computer.

Porta-Pow'r-Pak provides the C-64 or C-64C with all the voltages necessary for proper operation from any 13.8 VDC source. It will support datasette, user port, and game cartridge attachments. Users are reminded that C-64 memory expansion modules require more current than the supply can provide, though. Normal C-64 current requirements are under 1.8 amperes.

The unit measures 6" x 3" x 1.5" and weighs less than 12 ounces. Three cooling fins atop the flat black case provide heat sinking. A fused cigarette lighter plug provides DC power to the unit, while a 7-pin DIN connector attaches to the computer.

The device is user-serviceable, and those who like to dig into products will find the glass epoxy circuit board and component placement very professional. This is a quality product.

During extended operation the Porta-Pow'r-Pak gets noticeably warm, and the documentation warns of keeping the unit away from heat sensitive materials like plastic. The supply's wiring should also be kept away from the cooling fins to prevent possible damage.

The instructions inluded with the prototype show how to modify a Commodore 1541 disk drive for 12 VDC and 110 VAC operation. These instructions could be somewhat more explicit and should include better artwork for the modification. A successful conversion will allow truly portable Commodore computing. The Porta-Pow'r-Pak manual also refers to a 1581 power supply, not yet available, which will allow portable disk operations, also.

Portable packeteers, emergency volunteers, and mobilers should find the Porta-Pow'r-Pak pretty darned handy. The C-64 is a proven workhorse in thousands of ham shacks, and now there's nothing keeping those computers from field or mobile use. Like I said, Dave is a clever guy, and this product is a fine example of his handiwork.

Deluxe Transverter for 1750 Meters

Your Ticket to the VLF Experimenter's Band

by David Curry WD4PLI

What could possibly be interesting about a group of frequencies that are so low, most people mistake them for bandwidth? Or how about an antenna that for all practical purposes could be long enough to be used as a telegraph line between two midwestern towns? These large dimensions, and the mystery that follows the 1750 meter band, are just a part of the fascination that a few people, often referred to as "Lowfers," share in experimenting and communicating on this otherwise neglected band.

Unknown to many amateur radio enthusiasts, the FCC has allowed license-free use of frequencies from 160 to 190 kHz, with a power restriction of up to 1 watt input to the final, and a maximum antenna length (including feedline) of 50 feet. There are no restrictions placed on the receiving equipment used or the type of receiving antenna.

Surprisingly, one watt often offers powerful flexibility. My CW beacon "PLI" transmitting on 183.63 kHz is regularly heard several hundred miles away. Another station, Z2 transmitting from San Simeon, CA, has received reception reports from even greater distances: over 2000 miles away in Hawaii! The FCC does not restrict the mode of transmission, and everything from AM and SSB to CW and RTTY have been used succesfully.

Few people have mastered the 1750-meter band because of the lack of readily-available commercial equipment. You simply don't go out and choose the transmitter, receiver, and antenna you want. In most cases, you have to build your own gear, and with the right equipment and the right choice of antenna, the 1750 meter band becomes truly addicting.

Easy to Build Transverter

Transverting from 80 meters provides a simple way to get onto the Experimenter's Band. Home-brew transceivers often present complications, but transverting from most commercial equipment eliminates most problems. When the transverter is in the receive mode, the 80-meter band of your transceiver is converted into a longwave receiver capable of receiving any signal from 5 to 450 kHz. Any type of signal from AM to FSK can be received, only limited by the mode capabilities of your ham transceiver. The transverter is broadband, and does not require tweaking nor tuning either for receive or transmit operations.

During transmit operation, you simply transmit normally on 80 meters between the legal band limits from 3.66 to 3.69 MHz. The signal is converted down converted from 160 to 190 kHz, which are the lower and upper frequency limits of the 1750-meter band.

Remember not to transmit outside the band limits, either below 160 kHz or above 190 kHz, because these frequencies are used heavily by government, aircraft, and many other services. The transverter features a bandpass filter to eliminate transmission outside the 1750 meter band, as well as harmonic energy above 200 kHz.

Much of the guesswork and trouble that often leads to disappointment is eliminated with this proven circuit, leaving more time to explore and enjoy this truly amateur band.

Transverter Mixer

The heart of transverter is, of course, the mixer MX1. It upconverts receive signals on the longwave band to 80 meters, and downconverts transmit signals from 80 meters to the 1750-meter band. Remember that 1750 meters (160–190 kHz) is just a small portion of total longwave spectrum and the only area where you are allowed to transmit. The circuit uses a doubly-balanced diode ring, which provides an excellent dynamic range, low noise, and local oscillator rejection. You might think it would be necessary to use two mixers, one for receiving and the other for transmitting, but the diode ring mixer is changed to either receive or transmit by the relays K1 and K2. This eliminates the need or cost of using two. Let's imagine the transverter in the receive mode and start at the beginning of the circuit with the input port J1.

Receive Conversion

As you can see in the schematic (Figure 1), the input signal flows from J1 through relay K1A to S1 which is the "receive select" switch. This switch is useful if a different antenna for receive is required for improved reception such as a loop or active whip. In the normal position, it's connected to the 1750-meter port, J1, or switched to the auxiliary input. The received signal is sent through switch S1 to the input of the low-pass Chebyshev filter, comprised of C1-C4 and L1, L2. This filter has a very sharp roll-off starting at 450 kHz, which eliminates overload or IMD from strong AM broadcast stations and other out-of-band signals. Signals below 450 kHz pass with minimum attenuation.

Filter output is matched into the input port of Q1, a low noise, high gain J-FET operating in a grounded-gate, broadband configuration. The grounded-gate type of operation is known for good stability and low signal distortion. The gain of the amplifier is approximately 10 dB and compensates for the 6 dB loss in the mixer and the 4 dB lost in Q4 and the low-pass filter. The transverter is set as close as possible to unity gain. Output of this stage is transformed to 50Ω via T1 and routed through K1B to the input of mixer MX-1.

Unique LO Design

The local oscillator used here is an unusual design, first brought to my attention from an article about crystal oscillators by Ulrich Rohde. What makes this circuit so worthwhile is the way the crystal, Y1, is configured between the oscillator transistor Q2, and the Class A amplifier, Q3. Y1 placed in this fashion acts as a high-Q filter, which greatly attenuates harmonics and local oscillator noise. Capacitor C9 is used to adjust the crystal frequency to 3.5 MHz. Q3 operates in the common base configuration and amplifies the LO to approximately +7 dBm. At this point, the Pi-matching circuit, consisting of C15, L5, and C16, match the output of Q3 to the 50Ω input impedance of mixer MX-1.

The sum and difference frequencies from the output of the mixer go directly to load resistor R9 and the input gate of Q4, which is

used as a source follower. This gives optimum isolation between the mixer output and the next stage. There is a loss in using this type of circuit—the source of Q4 and the next stage acts as a voltage divider—but the advantages outweigh this disadvantage.

By using R9 as a load resistor for the output of mixer MX-1, all the sum and difference frequencies including their harmonics will see a true 50Ω load, which optimizes the 3rd order intercept point. Gate capacitance of Q4 is minimal and ignorable at these frequencies. This approach obviates the need for triplexers in the receive and transmit path. The source of Q4 is coupled to the receive port of the 80-meter transceiver through relay K2A and K2B, and the DC blocking capacitor C17.

J4 provides +12 Volts DC for operating any accessories or preamplifiers during receive mode, and goes low during transmission.

Transmit Downconversion

This next situation is the transverter in the transmit state, taking an 80 meter transmit signal from the amateur transceiver and downconverting it to 1750 meters. Point J1 is used as the control point to turn the Transverter from transmit to receive, or visa versa, and is connected to the terminal on the back of the transceiver that has a NORMALLY-OPEN and COMMON relay points.

Almost all transceivers have auxiliary or accessory terminals for controlling outboard equipment like this. A careful look in the manual or even a check (with the help of a VOM) of each point on the terminal, will reveal the points corresponding to the normally-open, common, and normally-closed relay positions.

Usually, the accessory jack is female with eight or nine pins, and includes a normally-open, common or ground, and a normally-closed pin. The normally-closed pin is not used while the common is connected to ground, and the normally-open pin connected to J3 on the transverter. This will synchronize the transverter to the transceiver by energizing K1 and K2, when going from receive to transmit and vice versa. If no connection to the transceiver is possible, a manual switch can change the transverter mode. One part of the switch is connected to J3, and the other part of the switch goes to ground.

During transmit K1 and K2 are energized. The RF power from the transceiver goes into the 80-meter port J2, through K2B and into the 30 dB attenuator pad which consists of R13–R18, R19, and R20. This pad lowers the signal to an acceptable level for the mixer MX-1. The signal goes through relay K1B, and into the mixer where it is mixed with the local oscillator. The output sum and difference frequencies from the mixer are sent to the source-follower transistor Q4, then through K2A to the low pass filter comprised of C19, L6, and C20. The filter eliminates the sum frequencies around 3.68 MHz, but allows the difference frequencies from 160 to 190 kHz to pass.

With the signal already filtered, it is ready to be amplified to a usable output for transmission. Transistors Q5 and Q6 operating in Class-A mode amplify the low-level signal from the output of the filter to drive output transistor Q7. Q7 is an inexpensive, durable audio transistor that has ample gain at these frequencies for maximum performance. The bias that sets Q7 in class AB operation is controlled by regulating transistor Q10. R32 adjusts the current through Q10, which in turn controls the quiescent current of Q7.

The collector of the PA transistor Q7 is coupled to the 50 Ω output impedance by transformer T3. T3 and C30, C31 form a tank circuit with a loaded Q that is low enough to cover the entire 1750-meter band. The output power from T3 is passed through relay K1A to J1, which is the 1750-meter antenna port.

For best results, it is very important that the transmitting antenna resonate at the desired frequency, and coupled to the transmitter efficiently. The transmitter PA is flexible to various forms of matching circuits, and a proven method follows later.

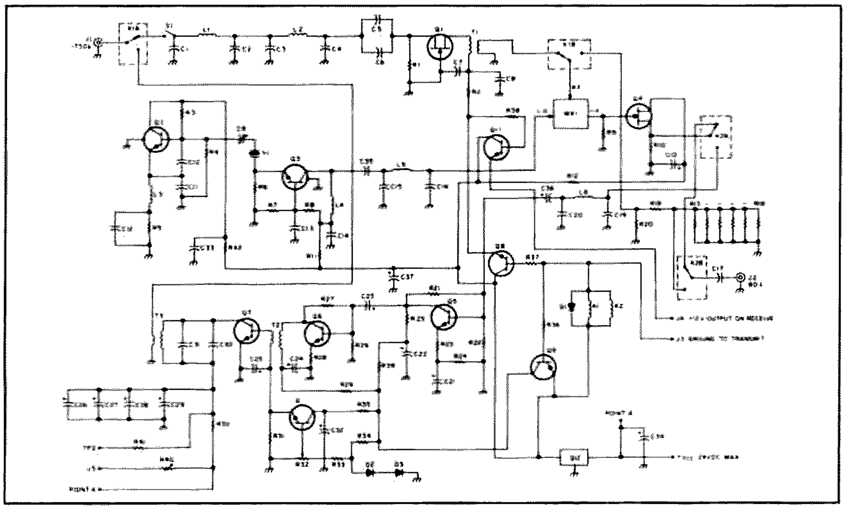


Figure 1. Schematic of the 1750 meter transverter. Note the unusual design of the local oscillator, which greatly attenuates harmonics and oscillator noise.

The transverter operates from a 24 VDC regulated supply, or any well-filtered and regulated supply capable of delivering at least 1 amp from 18 to 26 VDC. Q12 supplies a regulated 12 volts to all active components except the PA transistor Q7, which uses the power directly from the 18 to 24 VDC power input.

Construction

Figure 2 shows the circuit board positive to aid construction. A ground plane on the component side of the circuit board adds stability. An easy way to make the ground plane is to cover the ground plane side of the circuit board with masking tape before etching the board. Make sure the corners are especially well-covered. Only the foil side is etched; the ground plane side is left untouched. Remove the tape after etching and drill the holes from the foil side. Finally, use a larger drill bit to countersink the holes from the ground plane side enough to adequately clear all part leads through the board. The ground holes do not need to be countersunk.

The parts are inserted into the board using the component layout (Figure 3), viewed from the foil side through the board to the actual component. Each type of component has its own symbol, as shown in the illustration, to help visualize the type of part and its value. All components, except for three resistors R16–R18 (which mount against the foil side), are mounted on top of the ground plane side and part leads soldered on the foil side. Some grounded leads are soldered on both sides to improve the ground on the foil side, and are marked in Fig. 4 by the symbol, "/". Install resistors and capacitors first.

Q7 also uses the ground plane of the circuit board as a heat sink. Use a mica insulator between it and the board, and cover both sides of the insulator with heat sink compound.

Wind all toroid inductors evenly and tightly, winding the side that has the most turns first. After a toroid has been wound, strip the enamel from the wire almost to the body of the toroid, and insert the leads carefully into the circuit board. *Double check* to make sure that the transformer and coil leads are in their correct hole, as shown in the illustration. After all leads are pulled reasonably tight through the board and soldered, use a small drop of Krazy Glue™ between the toroid and the board to insure rigidity. Double check the parts layout against the drawing after installation. This will save you from a lot of head scratching later!

Receiver Alignment

This is very simple. You need an accurate receiver (preferably a frequency counter), and a VOM or VTVM. Apply any voltage between 18–24 VDC to the B+ point on the circuit board, and the ground connection to the point labelled "G". Next, confirm that the LO is working correctly and aligned. A frequency counter gives the most accurate frequency calibration. Connect the counter probe to Test Point 1, and the ground lead to

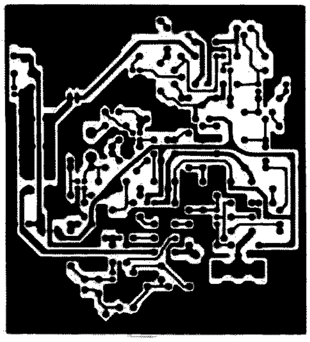


Figure 2. Circuit board positive for the project. Actual dimensions are approximately 4.7" x 4.3".

circuit board ground. The frequency should be displayed and C9 adjusted so that a frequency of 3.500 MHz is displayed. This now calibrates the LO.

If a frequency counter is not available, then first calibrate the transceiver as closely as possible to its reference, and tuning to 3.5 MHz. A piece of wire connected from the transceiver RF jack and layed close to the transverter board will pick up the LO signal. Adjust C9 for a zero-beat while watching the S-meter on the transceiver for minimum meter movement. This alternative approach is not as accurate as the first, but done correctly gives excellent results. This completes the alignment for the receive section.

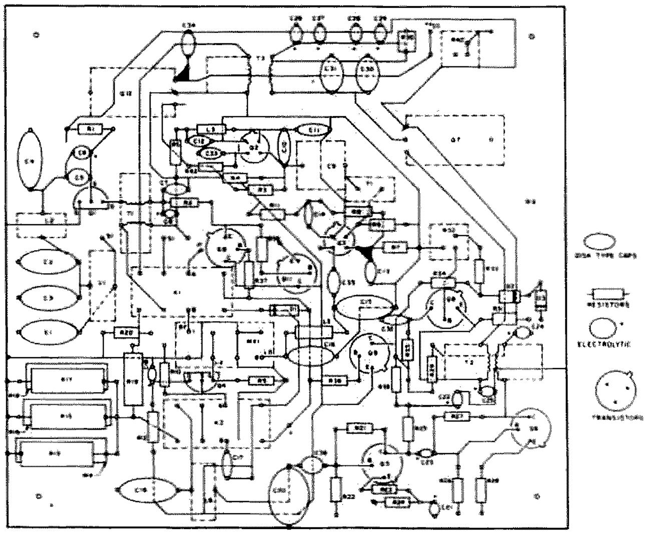


Figure 3. Parts placement for the transverter. A circuit board and parts kit are available. See text for details.

Transmit Calibration

Connect a coaxial line between the transceiver RF jack and transverter 80-meter terminal J1. Place a 50Ω dummy load made of two 100Ω, two-watt resistors connected in parallel to the 1750 terminal J2. This will simulate the 1750 meter antenna during our power test. Get out the VOM or VTVM and connect the red or positive lead to J5, and the black or negative lead to TP2. Adjust the meter so it can be capable of reading 200 mV DC.

Ground point J3 and listen for relays K1 and K2 to change over. With J3 grounded, check the bias of Q7 on the meter and set to 15 mV by adjusting potentiometer R32. The voltage read on the meter is actually the current to Q7, and so 15 mV is really 15 mA of bias current to operate the final stage in Class AB.

Now connect the transmit/receive control point J3 to the transceiver normally-open point on its accessory or transverter plug. Make sure that the common, or other point of the relay in the transceiver, is grounded. Tune the transceiver to 3.675 MHz, which corresponds to 175 kHz. Put the transceiver in Tune mode and listen for transverter relays K1 and K2 to close. Only 10 watts of peak output are needed to drive the transverter to full output, more may over-saturate and damage the transverter.

Set the transceiver to 5 watts of ouput and check the meter connected across points J5 and TP2 of the transverter. It should read a value above 100 mA. Avoid using higher currents beyond 500 mA for more than a few seconds. Adjust the output of the transceiver so the current on the meter is within the legal limits. For example, if the power supply voltage is 24 volts, and the meter current is 100 mA, the peak-to-peak input power is 2.4 watts (24 x.1). This is just under the maximum legal input because 2.4 watts PEP is just under 1 watt RMS (2.4/2 x.707 = .848 watts) DC input power.

The 50Ω dummy load should feel warm to the touch, indicating output power. The voltage can be measured between TP2 and ground for easy calculation of the input power. Return to the receive mode, and remove the dummy load.

The Antenna System

The transverter is now ready to be connected to the antenna system. Often separate antennas are used for transmission and reception. A long and high transmitting antenna may not be the best receive antenna, especially when used in urban or even suburban environments where noise radiating from power lines and neighbors' light dimmers can be obtrusive. The name of the game is to achieve the best signal-to-noise ratio possible. and the best way to do this at the receive end is to use some stategy in choosing and locating a receive antenna.

Two Good Receive Antennas

The Loop antenna has been around for ages and there are many articles covering its proper design and application. In my location, I would be helpless without using one of these for reception, since the high level of power line hash can be easily nulled out. The loop is made of 30 conductor computer ribbon cable with the wires at each end stagger-soldered to produce one continuous electrical path. This is tuned easily with a standard 365 pF variable capacitor and is preamplified before going to S1 on the transverter. I experimented placing the loop in different parts of the yard and discovered a quiet spot furthest from the power lines and equidistant between two apartments. The loop was planted at this spot and rotated for the deepest null in the noise obtainable. Simpler forms of noise such as light dimmers and pulses can usually be eliminated with the noise-blanking switch on the transceiver while complex noise, such as power line hash, is eliminated better by nulling with a loop or phase cancelling.

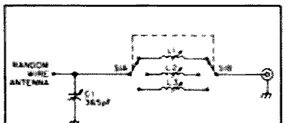


Figure 4. A simple random wire antenna tuner used for reception.

Another effective way to reduce noise is by using an active whip antenna. This is a high impedance, broad-band vertical antenna that is usually around 3' high and has its own preamplifier. It is mounted in a remote location away from power lines and in an area clear of structures. I also use an active whip mainly for general LF listening, and it is mounted on a wood pole at the top of a tree 60' in the air above all the houses and powerlines. I would not receive a tenth of the signals at the base of the tree as I could high in the clear. There are some excellent articles by Ralph Burhans on building or buying active whips, and I highly recommend both the active whip and the broadband active loop. Remember that the location of the antenna, even a few feet, can be the difference between success and failure. Don't let anyone snow you into thinking your loop or active whip will work as well in the garage as it will in the clear part of the backyard. It won't.

Figure 4 shows a simple tuner that works well for general listening using a wire antenna from 50 to 200 feet in length. The coil is selected to resonate the antenna at the desired frequency, using C1 for additional flexibility. Again, erect the antenna as much in the clear as possible.

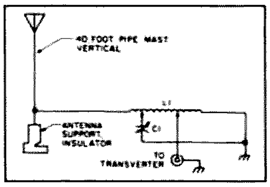


Figure 5. The author uses this antenna configuration, which allows operation on both 160 and 1750 meter bands.

Good Ground Essential

Another point that cannot be overstated is the importance of a good ground, which is neces-

sary for transmitting efficiently and receiving a lower noise floor. A ground radial system for the transmitting antenna works well and will be discussed in more detail. Ground rods work, but several copper 10' pipes driven into the ground around 10 feet apart and strapped together will outdo a single 3' ground rod.

In areas of rocky, sandy or otherwise poor soil conductivity, it's better to concentrate entirely on a good radial system around the transmitting antenna. Treat the cold water pipe grounding system as a last resort only.

The transmitting antenna I recommend is a vertical antenna with the largest capacity hat possible. In general, a 50' 1750 meter vertical antenna acts much like a 160 or 80 meter mobile antenna, and there is plenty of information in the handbooks to gain a deeper understanding of this similarity. In fairly quiet locations, the transmitting vertical antenna works well for receiving, but limited to the resonant frequency of the antenna. By following a few simple tips, a good transmitting antenna can overcome even the worst locations. Keep the vertical antenna in a primarily clear area away from trees and structures. This type of antenna has a very high Q and becomes sensitive to nearby objects.

The largest ground plane possible should consist of as many wires as practical, starting from the antenna base and laid outward in a radial fashion, which contributes greatly to a strong signal.

It is not necessary for the radials to go beyond a length of 60 feet, since a resonant ¼ wave radial at these frequencies is impractical for most uses.

The antenna-loading coil should be wound with eitherLitz wire, or #18 gauge or heavier Formvar™ enameled wire. The coil form should be made of a high, dielectric quality and usually ranges in size around 4 to 8 inches in diameter, and 6 to 8 inches in length. A glass water bottle, large PVC pipe, or several wood dowels mounted in a circle on a wood base that could simulate a large coil form will work quite well. Do not use the black type of PVC pipe or cardboard forms for loading coils as these and similar types can spoil the Q of the coil or fall apart later. Fiberglass resin or liquid Varathan™ work very well for weatherproofing the coil once completed.

Dual Band Antenna

I use a transmitting vertical antenna with an 8' capacity hat and a small loading coil so the antenna can be switched over and also used on 160 meters as a top-loaded current-fed vertical (see Figure 5). The antenna uses a large diameter Coke bottle half-sunk in a concrete block as the base suport insulator. In my particular installation, I use a high-voltage relay to switch the antenna from either 160 or 1750 meters.

The antenna is current fed on 160 meters using a large, air-type variable capacitor, but when switched to 1750 meters, the antenna is connected to the top of the loading coil with the bottom part of the coil grounded to the radial and/or ground system. The coax braid from the transverter coax line is also grounded, while the center conductor is experimentally taped 4 or 5 turns up the coil from the ground end. A small neon bulb like the NE-2 can be held close to the vertical during transmission to indicate resonance at maximum brilliance.

A field strength meter built out of any of the handbook circuits is very effective to indicate resonance. It is easy to accidentally resonate any antenna of this type on a harmonic, which can cause confusion later. One way of telling if this occurs is if there is a large increase in background noise when receiving at frequency. If the noise floor increases and peaks somewhere above the band limit (190 kHz), then C1 in Figure 4 can be added and adjusted to pad the coil down within band limits.

It is much more efficient to use as little capacitance of C1 as possible, and simply means that more turns must be added to L1 to increase the inductance, and bring the vertical antenna to resonance within band limits. If the coil is wound too large, you will notice it will resonate below the band limit (160 kHz). C1 should be disconnected, and turns gradually taken off L1. When the antenna is resonant within the band, a good listen will reveal the activity in your area, and clear frequencies free of carriers and other signals.

"If the 1750 meter band seems tough at first, don't give up!"

Usually, once a clear spot is found, it is used as the transmitting frequency, and final matching of the transmitter to the antenna will happen. Place the transceiver in the "tune" mode and experimentally adjust the coaxial tap point on L1. Using the neon bulb as an indicator, find the best tap point on the coil when the bulb indicates maximum brightness. A more scientific way to find the coaxial tap point is to use a 50Ω simulation.

Connect the 50Ω dummy load, and while transmitting, find the AC voltage or current using an oscilloscope or AC voltmeter or current meter. Once the value has been noted, connect the transmitter to the antenna and adjust the tap point, monitoring the voltage or current at that point and setting the tap point where the voltage or current is the same as the one that was checked across the 50Ω load. This will simulate a 50Ω load at resonance.

The final adjustment is made by adjusting C1 and the tap points on L1 while transmitting a peak indication on the neon bulb or signal strength meter, which coincides with the right value of voltage or current measured at the tap point. Once you do it a few times and gain a "feel" for matching the antenna, it becomes quite simple. It's worth keeping an eye out for RF current meters in the .1 to 1 amp range at swap meets and related ham functions, since they are worth their weight in gold to the experimenter.

Final Thoughts

If the 1750 meter band seems tough at first, don't give up! Working harder to gain an understanding of the way things work on LF has kept me devotedly interested in this band for over 15 years, and the possibilities of what can really be done here is limited only to the imagination. 1750 meters has grown up over the past couple of years thanks to experimenters introducing better circuits and more state-of-the-art equipment.

Full detail on the different aspects of 1750 meter equipment and operating techniques can be found in a number of *The Lowdown*, published by the Long Wave Club of America, 45 Wildflower Rd., Levittown, PA 19057. Membership is $10 per year in the US, and $18 per year overseas. This is worthwhile for general LF activity including 1750 meters, and is published monthly. Another publication that specifically focusses on 1750 meter activity is the *1750 Meter Western Update*, 226 Charles St., Sunnyvale, CA 94086. This is a monthly newsletter and can be obtained by sending 12 business-size, SASE (22-cent) envelopes to the above address, with a donation for copy costs for a full year of issues.

Some specific issues for further information about receiving and antennas is the June 1985, May 1985 and March 1987 *Lowdown* issues featuring circuits by Ralph Burhans and Mitchell Lee on active broadband loop receive antennas.

Ralp Burhan has details of various 1750 meter accessories available by writing: Ralph Burhan, 161 Grosvenor St., Athens, OH 45701.

The transverter shown in this article is available in kit form and includes all parts, circuit board, and instructions from Seden Communications, 1272 Harold Ave., Simi Valley, CA 93065. Also available from Seden Communication is the 1750-meter antenna loading coil and other related items. Call (805) 583-5687 or write for prices and more details.

The Southern California SSB Net meets every Saturday morning at 10 AM local time on upper sideband on 182 kHz. We welcome local response.

David Curry is an avid Lowfer and holds a General class license. He can be reached at 4415 Cahuenga Blvd., Toluca Lake, CA 91602.

Continued on page 53

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NAME	CALL	QTH	CONTACTS	SCORE
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2. Dave Hallidy	KD5RO	Piano, TX	25	1625
3. Louis A. Poche	KD5XE	New Orleans, LA	15	525

CALL	SCORE
4. KB5VC	260
5. N5FTT	240
6. KA5TTL	240
7. N5GWF	240
8. KA5UAI	240
9. N5HML	240
10. KB5XZ	240
11. KA5QLC	240
12. WA6GDF	160
13. KJ4BF	140
14. W6YLL	129
15. N3ELM	120
16. WB4WXE	120
17. N8INX	120
18. WA5ZIB	100
19. N5FUW	100
20. KA5CSI	100
21. KB6JIY	91
22. WA4OWC	75
23. KU6U	71
24. WB4YLR	60
25. NY0T	60
26. K7RDH	50
27. KD8RC	50
28. N5IUF	50
29. KG6MW	47
30. WA2HUF	45
31. WB8HFZ	45
32. N7AQM	41
33. KB9SH	40
34. WA4FQT	40
35. WA2VWG	37
36. WA6BVN	37
37. KB8AER	35
38. W7FBV	35
39. K6MBN	30
40. W7KXB	25
41. W4NJK	24
42. WA8VSY	23
43. KA7UBC	23
44. KB7ACP	22
45. W9HJM	20
46. W6GTZ	20
47. WP4FWT	20
48. WB5CHV	20
49. KE5O	20
50. WB2JHG	20
51. KA3LLQ	20
52. KA9YVZ	20
53. WB7SLY	16
54. KA8JQW/8	15
55. N8AXA	15
56. KA8JQX/8	15
57. K5JT	15
58. WA2SNQ	15
59. K8BL	15
60. NF8K	15
61. WA5YKO	11
62. WB5FWE	10
63. WB5RMA	10
64. VE3CK	10
65. KA2PES	10
66. N2DF	10
67. VE3KRP	10
68. K3SDL	10
69. WD8MYN	10
70. WB7UNU	10
71. KI6PL	10
72. KB6MPJ	10
73. WB0YFL	10
74. KA0NFW	10
75. WB0JIU	10
76. K8VEX	10
77. KE6JC	10
78. WB5NGC	10
79. N2HEQ	10
80. VE3CX	10
81. N2GKM	5
82. WB2JXY	5
83. WB2TVX	5
84. K2AWA	5
85. WB6GWW	5
86. N9HH	5
87. N0IS	5
88. WA9CAT	5
89. KA4TUT	5
90. WB8VYW	5
91. WB8LCD	5
92. WB2OEB	5
93. N2GRT	5
94. KA7VNO	5
95. AD7I	5
96. WB1FVS	5
97. K9LL	5
98. K1POP	5
99. WA9FIH	5
100. KB4ZHM	5
101. KB4ZHL	5
102. WL7AZB	5
103. KB4ZFA	5
104. KB4ZHE	5
105. N8FVG	5
106. WD4MWQ	5
107. N4MOP	5
108. WZ4K	5
109. KA5VBL	5
110. KA5UOA	5
111. KA5TQY	5
112. AJ9K	5
113. KA5ROZ	5
114. WA7JUO	5
115. KB8DBK	5
116. NA1O	5
117. W9GXR	5
118. WA5OSD	5

Other Participants

KA8TIL	WA4WSS	KA1IYN
AD0V	N6JXI	W5UA
N4OSD	KA7YOU	KB4VPN
K8TLY	W9IFT/9	N8FES
NT8M	KA9UCE	WA6ARA
KA3BOZ	W9MVP	KB6TIU
KF6QB	WAIXIH	WG4N
WB5EVF	KB8APK	KY3F
NS5N	N8IJW	KB6ONO
N7BZD	N8HAM	WB0VCC
KA7OKJ	KA2BPP	KA7WRP
KK5D	K2FH	WB9WVK
KD2GC	KB6RBY	KD9PR
N9DKC	KB6RBX	WV5F
N8HVQ	WA8QAA	W6ORS
N0ICK	WA8UXL	KA5ZIF
K4FHQ	N0HPJ	W7XU
WL7BKW	KA9MGD	KC3CF
KB5DFY	N3FJQ	WB8FWE
N4PKR	W5SSB	KB8S
N2FQM	KB5AUM	WD5H
KC4AQC	WB2CZC	KA3QJY
N0FMR	NM2I	KA0RRL
K4KCC	N4ACS	
WB5IKO	N5JJY	

The Micro-20 Receiver

Advanced technology makes this superhet a snap.

Rick Littlefield K1BQT

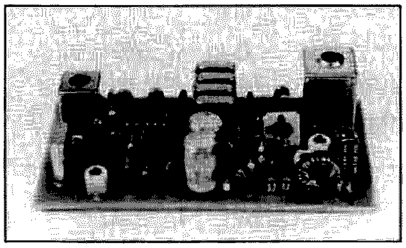
In the past, designing QRP rigs usually meant agonizing between direct-conversion simplicity and superhet performance. Fortunately, recent advances in receiver technology now enable us to build full-featured superhets in DC-simple packages. Here are three reasons why.

The first is the Signetics NE602 mixer IC. This inexpensive device combines a double-balanced mixer, local oscillator, and bias network on one 8-pin chip.[1] Although designed for VHF compandered sideband applications, the NE602 is a natural for amateur projects, since it requires few external parts, works well as a mixer or product detector, and provides up to 20-dB of conversion gain at HF frequencies.[2]

Another important innovation is the recent application of Cohn filters to SSB IF strips.[3] First described by Wes Hayward, this technique enables amateurs to tailor-made bandpass filters from inexpensive surplus crystals. This provides builders with an extremely attractive alternative to purchasing expensive sealed commercial units.

Finally, the increased availability of monolithic capacitors and other sub-miniature parts with .1" lead spacing allows designers to make PC layouts smaller—without overcrowding.

The receiver described in this article incorporates all three of these advances onto a single 1⅜" x 3" board. The circuitry employs four inexpensive ICs, two transistors, five surplus crystals, and a small handful of parts. Yet, sensitivity is well below the noise-floor of the 20-meter band, stability is excellent, selectivity is very respectable for a four-pole filter, and audio-derived AGC holds listening levels constant over a wide range of signals. In short, the receiver delivers the kind of performance that makes QRP operation truly enjoyable.



The Micro-20 Receiver

Circuit Description

This particular radio employs a traditional 9-MHz IF, 5-MHz VFO mixing scheme (see Figure 1). Many other IF/VFO combinations are possible by adjusting the tuned circuit values accordingly.

A double-tuned bandpass filter at L1-L2 pre-selects 14 MHz signals prior to mixing by U1. VFO injection is provided by the NE602's on-board oscillator. Frequency is determined by a Colpitts tank circuit L3, C7–C10. An optional "fine-tune" control is provided by R21, which functions as a small variable capacitor when connected as shown. The value of C34 sets the tuning range of R21.

The 9 MHz output of U1 is filtered by a four-pole Cohn crystal bandpass filter. Since CW operation was desired, values for C12-C16 are selected to provide a −3-dB bandwidth of about 1.0 kHz (reducing these values broadens filter response, permitting comfortable SSB reception).

IF amplifier U2 provides up to 50 dB of gain, with an AGC range of nearly 70 dB. T1 tunes the IF output and matches it to the signal port of product detector U3. U3's on-board oscillator is crystal-controlled to insure LO frequency stability. C23 nets Y5 to the desired BFO frequency. Audio output from U3 is rolled off by R7, C27 to help reduce wide-band amplifier noise and high-frequency QRM.

The audio amplifier and AGC system have been described in a previous article.[4] Audio amplifier U4 delivers about 200 mW of pow-

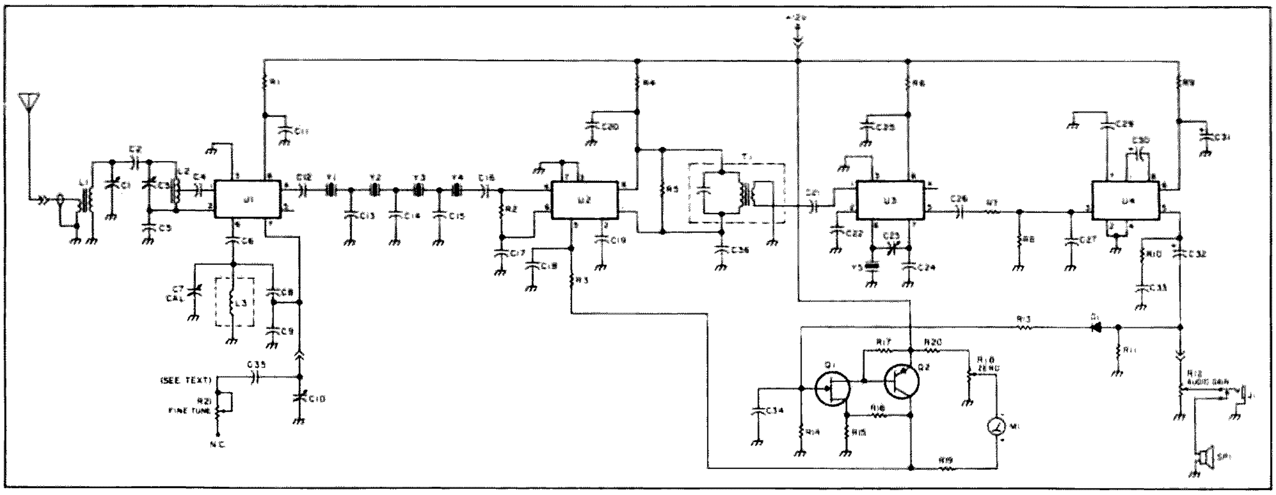


Fig. 1. Schematic diagram of the 20 meter micro receiver module.

er—enough to drive a small speaker or headphones. Since U4 is located within the AGC loop, it runs at maximum gain and relies on the AGC system to limit its output to a nominal level. R12, an attenuator, is located outside the AGC loop, and functions as a volume control for speaker or headphones. R11 insures that the output stage of U4 remains properly loaded when the speaker is disconnected or when high-Z phones are used.

AGC detector D1 samples U4's average output level, and sends a rectified control voltage to DC-amplifier Q1. C34 and R14 establish the AGC system time constant. Q2 drives the S-meter and AGC line. A quiescent output of 4.5-5 V (set by R16) holds AGC voltage just below U2's threshold until a signal appears. Voltage divider R18 zeros M1 by equalizing Q2's quiescent voltage at the negative meter terminal.

Crystal Selection

A close crystal match in resonant frequency determines how well the Cohn bandpass filter will work. Wes Hayward suggests holding frequency differences to within 10% of the desired filter bandwidth. This means a group of crystals selected for a 500-Hz filter should resonate within 50 Hz of each other, and crystals for a 2.7-Hz filter should resonate within 270 Hz of each other. I characterize crystals by hooking them into a simple test oscillator and reading the frequency of oscillation on a counter or digital-readout receiver (Figure 2). This enables me to select the right group of crystals for the particular filter I am building.

Construction

The board layout assumes .1" lead spacing for most components, so the first task is to select small parts. All resistors are ¼ watt and end-mounted. Bypass and frequency-critical capacitors should be either 50-volt monolithics, or low-voltage NPO disc ceramics. Small 100-volt silver-mica capacitors are preferred for C12-C16, but high-quality NPO discs may work nearly as well. The ¼" plastic form for L3 is a popular surplus item that has been stripped and rewound with #32 wire. If you have difficulty locating components, there are PC boards and a complete parts kit available from Radiokit, Box 973, Pelham NH 03076.

Mounting and soldering miniature components is really quite easy—if you use the right tools for the job. I prefer a 700° temperature-controlled soldering iron with a fine chisel tip. Keep a damp sponge handy for cleaning the tip. Hemostats, a sharp hobby knife, nippy-cutters, and a vacuum de-soldering tool are all extremely useful tools. A board vice and magnifier lamp are optional, but nice to have.

Refer to Figure 3a for parts placement and lead locations. It may be easier to wind VFO coil L3 after the coil form has been mounted on the board. Be sure to secure windings with a coat of clear nail polish before installing the shield can. As you populate the board, double-check component polarities and IC placement-keys before soldering in place. Figure 3b shows a bottom view of the board. Two jumpers and a bus-wire lead for C10 must be installed on this side. When construction is complete, it is good practice to clean the foil side of the board with flux stripper and inspect it for solder bridges or cold joints.

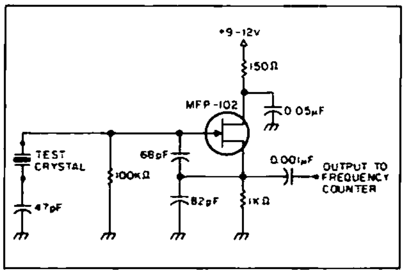


Fig. 2. Test oscillator for characterizing surplus crystals.

Mounting the module is not critical, but follow the usual precautions to insure VFO stability. My receiver is mounted in a Ten-Tec TG-series box, and plenty of additional space is available for a battery pack or companion QRP transmitter. Figure 4 shows module wiring.

Testing and Alignment

Once wiring is complete, apply 12 volts from a regulated supply—and check for smoke. A faint hiss from the speaker indicates working audio circuitry. Here is the recommended alignment procedure:

1. Zero the S-meter by adjusting R18.
2. Check the quiescent AGC voltage at the top of R16 to confirm that it is between 4.5 and 5 volts. If the reading is out of that range, substitute a different value for R16.
3. Check U3 for BFO oscillation. You should hear a shift in speaker noise as you adjust C23. Set the BFO frequency 1.5 kHz below the filter's center frequency (8998.5 kHz).
4. Peak the slug in IF transformer T1 for maximum noise. Note that C36 lowers the resonant frequency of T1 slightly, to insure that it will peak at 9 MHz.
5. Check the VFO for oscillation with a scope, frequency counter (Hi-Z probe on pin 7), or general coverage receiver. Receiving frequency is determined by adding the VFO frequency to the IF frequency (9000 + 5.250 = 14.250, etc.). Calibration control C7 provides some frequency adjustment, but large corrections may involve removing turns from L3 to raise frequency, or adding capacitance across C7 to lower frequency. Tuning range will be around 150 kHz with a 50-pF variable at C10.
6. Once both oscillators are functioning properly, connect a 20-meter antenna and adjust C1 and C3 for maximum sensitivity. Two distinct peaks per revolution indicate that each tuned circuit is resonating properly. The NE602 mixer has a very low noise figure, and the receiver has plenty of gain. Consequently, connecting and disconnecting the antenna should produce a marked change in the background noise level.
7. Check AGC action by tuning across a strong sideband or CW signal. The S-meter should deflect to nearly full scale, and audio should be undistorted and free of obvious pumping (overdriven AGC) or cracking (under-driven AGC). If one of these conditions is noted, changing the value of R13 will adjust AGC drive. If your meter movement is more or less than 200-μA, change R19 to provide the proper range of deflection.

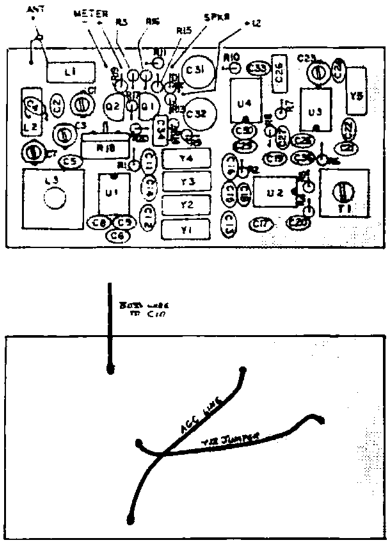


Fig. 3. Parts layout of the receiver. Top (3a) and bottom (3b) view.

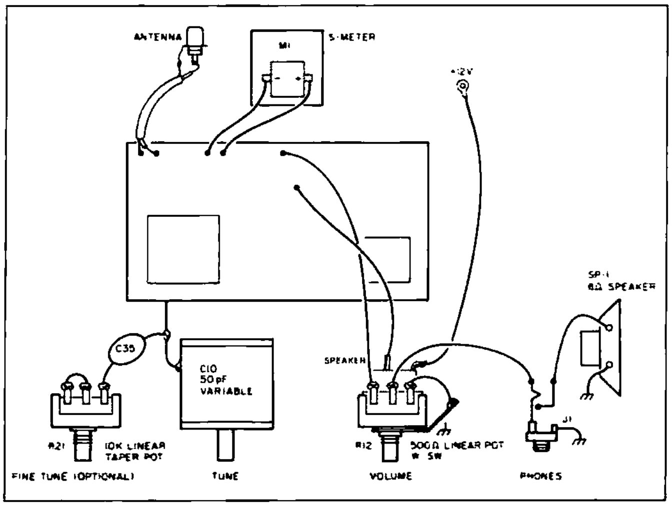


Fig. 4. Module connections.

8. Check the response of your crystal filter by tuning across a heterodyne. As you tune through zero beat, the opposite sideband should be much weaker or barely audible. Excessive ripple, indicated by exaggerated up-and-down S-meter movement when tuning through the desired sideband, may indicate improper filter termination. Shallow skirts may mean one or more of the crystals are too far off the filter's design frequency.

When choosing a power supply, note that the IF/AGC circuitry is voltage sensitive. The voltage source should be regulated to between 11.5 and 12.5 volts. Significant departure from this range will deteriorate receiver performance.

Options

Here are some possibilities for modifying or adapting the design.

1. For optimal SSB reception, reduce C12-16 to 68-pF, and increase R2 to 820-Ω.
2. Changing pre-selector filter value for resonance at 3.5–4.0 MHz region will permit 80-meter operation. However, for LSB reception, BFO frequency must be shifted to 9001.5 kHz.
3. If 9-MHz region will fall within the tuning range of IF transformer T1. IF frequencies as low as 8 MHz may be used by increasing the value of C36. VFO L and C values must be adjusted accordingly. Also, 3.579-MHz color-burst crystals may be used, if T1 is replaced with a lower-frequency LC circuit.
4. One immediate disadvantage of the NE602 on-board oscillator is the lack of a buffered output to drive a transmit mixer. However, transceiver frequency control may still be possible. A 200-mV oscillator signal (emitter level) can be picked up at pin 7. This is sufficient to drive a simple external FET buffer (Figure 5).

Conclusion

Recent innovations like the NE602, simple Cohn IF bandpass filters, and the availability of sub-miniature parts make "bare-bones" superhets an increasingly attractive alternative to direct conversion. Building a QRP rig takes time and money no matter which way you go. So, why compromise performance when you can have the best?

References

(1) "SA/NE602 Double-balanced Mixer and Oscillator," Linear Products Group, Signetics Corporation, September, 1985.

(2) "Build a Pocket-portable SSB Receiver," Klinert, Ham Radio, November, 1986.

(3) "Designing and Building Simple Crystal Filters," Hayward, QST, July, 1987.

(4) "Compact 20-meter CW Travelradio," Littlefield, Ham Radio, June, 1987.

Rick Littlefield K1BQT got his ticket at 13 in 1957. Now he's an Extra and publishes in many major amateur publications including CQ Ham Radio *(Japan). His forte is building compact QRP equipment.*

Rick is a professional writer/producer for video training materials and owner of Omnicom Productions in Barrington NH. He can be reached at Box 114, Barrington, NH 03825

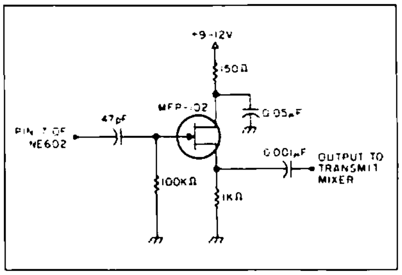


Fig. 5. Buffer circuit. This allows the NE602 on-board oscillator to drive other stages such as a transit mixer.

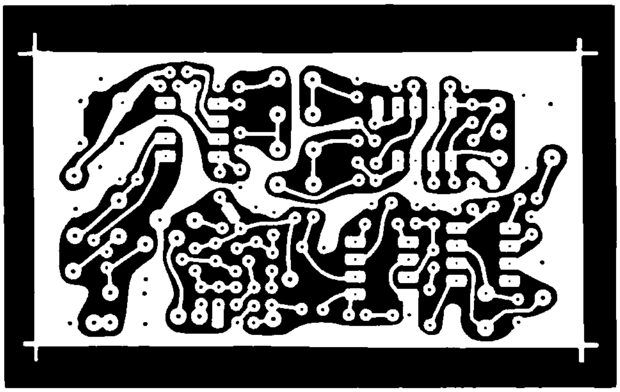


Figure 6. Printed circuit board negative for the 20 meter receiver.

Parts List

Semiconductors:

U1, U3	NE602 double-balanced mixer IC
U2	MC1350P IF amplifier IC
U4	LM386 400-mW audio amplifier IC
Q1	MPF-102 J-FET
Q2	2N3906 PNP
D1	1N914 switching diode

Crystals:

Y1–Y5	9000 kHz, .001% series resonant, .2" spacing.

Inductors:

L1	22 turns #26 on T37-2, 2-turn link on cold end.
L2	22 turns #26 on T37-2, center-tapped.
L3	38 turns #32 on ¼" form, no slug, 13mm shield can.
T1	10.7 MHz IF transformer, 10mm, green core.

Capacitors:

C1, C3, C23	60-pF trimmer
C2, C34	4.7-pF, 50-volt NPO
C4, C21	.001-µF, 50-volt monolithic
C5, C6, C11, C17, C19, C20, C22, C25, C29, C33	.1-µF, 50-volt monolithic
C7	8-pF NPO trimmer
C8, C9	330-pF, 50-volt NPO
C10	50-pF variable, 6:1 reduction drive
C12–C16 (5)	100-pF, 100-voll silver mica (see text)
C18	.01-µF, 50-volt monolithic
C24	47-pF, 50-volt NPO
C26, C34	1-µF, 50-volt monolithic
C27	.068-µF, 50-volt monolithic
C30	10-µF, 16-volt tantalum dip
C31, C32	100-µF, 12-volt electrolytic
C36	15-pF, 50-volt NPO

Resistors:

R1, R6, R7	1.8kΩ, ¼W
R2	680Ω, ¼W (see text)
R3, R5, R13, R17	10kΩ, ¼W
R4	100Ω, ¼W
R8	47kΩ, ¼W
R9	22Ω, ¼W
R10, R11	15Ω, ¼W
R12	500Ω linear pot with off/on switch
R14	2.2MΩ, ¼W
R15	1kΩ, ¼W
R16	3.9kΩ, ¼W
R18	20kΩ miniature trim-pot
R19	3.3kΩ, ¼W
R20	1kΩ, ¼W
R21	10kΩ linear pot

Miscellaneous:

M1	200 µA S-meter
SP1	2¼" or 3", 5Ω Speaker
J1	⅛" closed circuit phone jack

Optional Fine Tune Circuit:

R20	10kΩ linear pot.
C35	4.7-µF, 50-volt NPO

1750m

THE EXPERIMENTERS BAND

Here's How to Dabble on 160—190 kHz

by Ken Cornell W2IMB

Tired of the 20m SSB crowd? Hate contest weekends? Have a hankering to build a simple transmitter? Want a real challenge? C'mon down to the low frequency (LF) band and join the fun, and you can leave your ham license behind!

It's a great big world out there! All hams know about Part 97 of FCC Rules and Regulations, which governs licensed amateur operations. Most have yet to discover the great fun that Part 15 allows, although some may recognize this section covers the use of nonlicensed transmitting devices.

In Subpart D, Section 15:112, they permit the operation of a radio transmitter as follows:

(a) The power input to the final radio frequency stage (exclusive of filament or heater power) does not exceed one watt.

(b) All emissions below 160 kHz or above 190 kHz are suppressed 20 dB below the unmodulated carrier.

(c) The total length of the transmission line and antenna does not exceed 15 meters.

Any type of transmission mode can be used with the exception of Class B (damped waves).

Let me tell you, 1750m can rejuvenate that radio experimenter's spirit so many hams find fading these days. QRPoperations at 160 kHz are like no other ham experience. It's a challenge, allright, and a heck of a lot of fun.

Who Uses 1750m?

The 1750m band was a "sleeper" until the late 1960s when small groups of experimenters, mainly hams, began to operate on it. They call themselves "Lowfers," short for Low Frequency Experimental Radio Station. Lowfers make up their own calls. The rules allow use of any callsign unless it belongs to an authorized station, including those in the amateur radio service.

Initially, small groups clustered in the Northeast and on the West Coast. They ran beacons and used the 160m and 75m phone bands as back-up communications. Contacts over more than 100 mile were considered real DX! Vast improvements since then in antennas, transmitting, and especially receiving techniques, led to reception reports over 2000 miles away.

Make no mistake, 1750m presents some serious challenges for the experimenter. These require strategy to overcome, and those with successful strategies reap the rewards of true radio pioneers. Take a look at some of the common problems of LF and how to get around them.

The high noise level in LF is the worst problem. Unfortunately, most of this noise is man-made. Appliances, light dimmers, and power lines arc common sources. Some of the noise comes in on power line feeds into the home.

Assuming a good, efficient receiver, first sort out all the possible noise sources within the home. A good power mains filter will help reduce imported noise. Running the receiver on battery power is better still. Flourescent lights are noisy and can cause serious trouble if located in the shack. Schedule appliance use as much as possible around your operating schedule.

About Antennas & Transmitter

Avoid automatically slinging up the highest and longest wire antenna possible. Depending on the location, it may be a terrific noise collector! Try, instead, to achieve the best signal-to-noise ratio (S/N) possible.

An active antenna may help for a noisy location. This is a relatively short whip mounted on a weathertight housing that contains a broadband preamplifier. Use coax to connect it to the receiver and power source through an isolating network. This type of antenna is small and easy to mount and can be moved around the average home to find the best S/N location.

Another popular antenna is the loop type. They come in various designs, but they all have the classic "figure 8" pattern. Use the nulls off the sides to attenuate a noise source.

The transmitting antenna should be vertical and located in as clear an area as possible to avoid RF-absorbing structures and trees. Use a good ground system. Lay as many radials as possible on the ground around the antenna.

Try to get an antenna configuration that fits into an imaginary cylinder 15 meters high by 15 meters in diameter, to take maximum advantage of the legal size. The transmitter should be within, or at the periphery, of the circle. Despite the low power, high RF voltage will be on the antenna, so all supports should be extremely well insulated.

Practically all Lowfers today use solid-state transmitters. Most of the popular designs use high frequency crystals with ICs that divide the frequency to come out at the desired frequency. Most use power FETs, such as the IRF series or the VN types, as a final amplifier. When using ICs, the only coil normally required is the antenna loading/coupling coil. This coil should have a high "Q." Most Lowfers use Litz wire for the coil.

Information Sources

Palomar Engineers (Box 455, Escondido, CA 92025) market a number of receiving accessories for LF, including loop antennas and a VLF converter to receive 10–500 kHz on a standard shortwave receiver. An excellent source of transmitting and receiving hardware is LF Engineering (17 Jeffry Road, East Haven, CT 06512) founded by Sal DeFrancesco K1RGO. LF Engineering publishes a sizeable catalog of receive converters, preamplifiers, antennas, a transmitter, and miscellaneous accessories. Their catalog also provides some useful engineering information on operating in the 1750m band.

The Longwave Club of America publishes The Lowdown, essential reading for Lowfers. The monthly bulletin shares readers' experiences, prints projects, and covers LF propagation.

It is available for $12 per year from LWCA, 45 Wildflower Road, Levittown, PA 19057.

On the Air is published by Brice Anderson and is a useful source for a list of active Lowfers and their operating schedules. Write to Brice at Box 14, Lancaster, PA 62855. Hal Murken (19 Hobby Lane, Oakland, NJ 07436) publishes The Lowfer Letter, an excellent forum for LF DXers. The Western Update lists beacons and includes construction projects and other information of interest to Lowfers. Write to Jim Ericson, 226 Charles Street, Sunnyvale, CA 94086. Send business-sized 22 cent SASEs for these publications.

There are more than 100 known Lowfers—plenty of room for more! Here's a chance to really have some fun running QRP in an area where radio started, and it doesn't even require a license! For the circuit builder, antenna experimenter, or just the serious listener, the challenge of "lowfing" could really add the spark of inspiration that's missing from a lot of hams' hobby lives. Give it a shot. See you down the log!

73 Review *by Larry Ledlow, Jr. NA5E*

Ludvigson Tonegen

A Service-Oriented Tone Generator for the Commodore 64

Ludvigson Electronics
415 N. Duluth
Sioux Falls SD 57104
Pnce Class: $12.95

Hams and other electronics hobbyists often find themselves in need of major test equipment. Most electronic service and test equipment carries a price tag well above what most individuals and clubs care to shell out, especially for part-time work. After all, why spend thousands of dollars on equipment needed only occasionally? Equipment rental is a solution, but Dave Ludvigson has an even better one.

The Ludvigson Tonegen software for the Commodore 64 goes a long way towards meeting a lot of maintenance needs. When coupled with an additional, easily built hardware interface—not supplied—a Commodore 64 turns into a very versatile piece of test equipment. Table 1 lists all of the functions Tonegen software provides. The signaling, function generation, and lookup tables can serve any number of purposes, but repeater enthusiasts should find this software especially useful.

For field service, Ludvigson also sells a Porta-Pow'r-Pak converter that will power a C64 from 12 VDC.

No fancy graphics here, just straightforward menus. Tonegen is a basic, disk-based program that will satisfy a lot of complex service needs. Besides, the price is right.

Although the hardware interface is not difficult to build, I suspect many more people would rather purchase a complete hardware/software package for a little more money. I can only recommend that as an improvement. 73

TONEGEN performs the following functions:

A. Monotone signalling from 0 to 3950 Hz.

B. Triangle, square, and sawtooth wave forms.

C. Two-tone sequential encoding, with user-definable time duration.

D. 12-Key DTMF encoding, using a string of up to forty digits.

E. Digital dialing, using 400, 1000, or 2805 Hz.

F. Sweep generator operation.

G. Color bars and other video outputs.

H. Motorola capcode to two-tone sequential frequency conversion.

I. CTSS code to frequency look-up table.

J. Effective radiated power calculations.

K. Self-contained user's manual.

The TONEGEN Hardware Interface

The circuit on right is all that is necessary to utilize TONEGEN to its full capacity. Construction methods are not critical—use the PC board layout (Fig 1.) or perfboard. Note that the majority of this circuit is used to pulse the digital dialing relay via the user port. If you don't plan on using digital dialing, or if you just want to play with TONEGEN in a hurry, simply wire up the bottom half of the schematic. This will provide all of the tone functions.

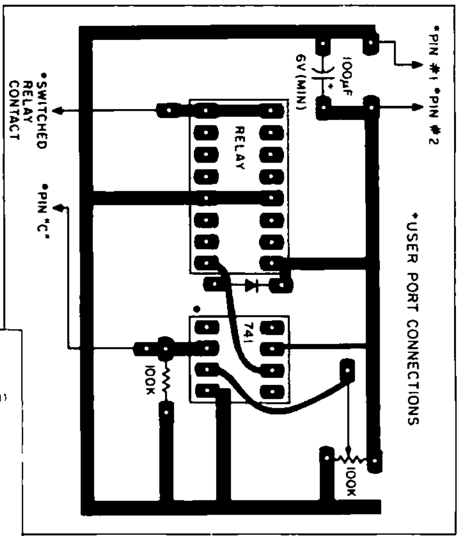


Fig. 1. PC board layout for the audio/video port interface.

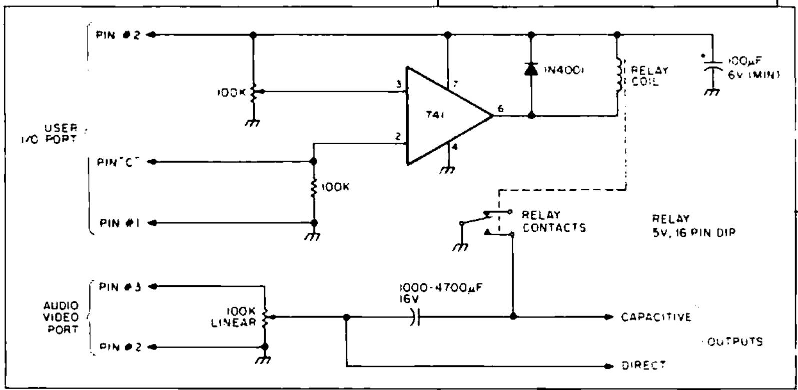
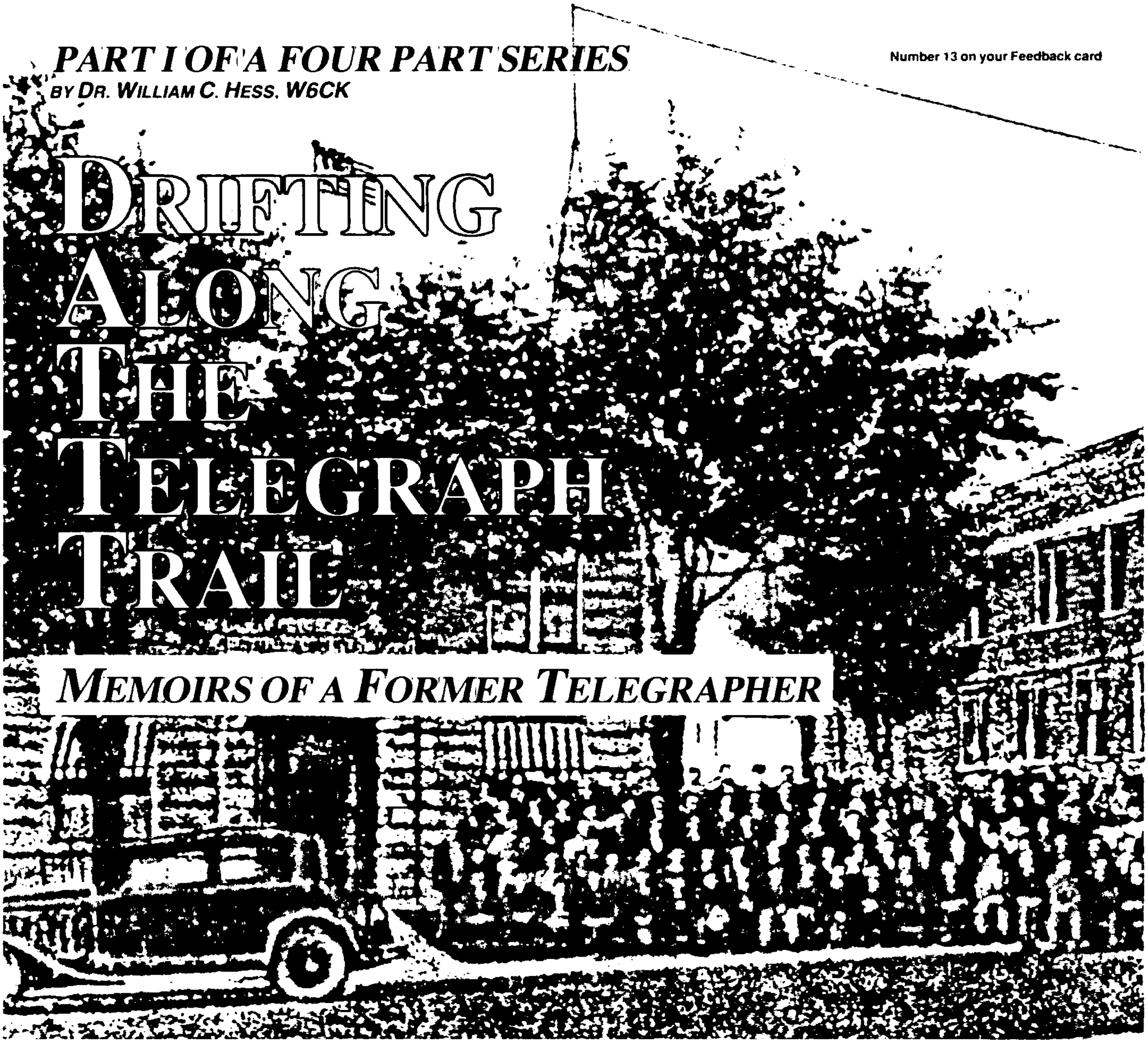


Fig. 2. Schematic for the audio/video port interface. Ludvigson does not supply this interface.

PART I OF A FOUR PART SERIES

Number 13 on your Feedback card

BY DR. WILLIAM C. HESS, W6CK



DRIFTING ALONG THE TELEGRAPH TRAIL

MEMOIRS OF A FORMER TELEGRAPHER

"*Stop him!*" was the command I received from Western Union's wire chief at Fargo, North Dakota, on an August evening in 1945. I had copied telegrams for more than two hours from the Great Northern Railway's station agent at Michigan City, North Dakota. These messages were, of course, sent via landline telegraph in American Morse code.

I immediately opened the switch on my Ultimate brand bug. This caused the telegraph circuit to open to "MC" (the telegraph call sign for Michigan City). The MC operator could not send any more until I reclosed the switch on my bug.

The Wire Chief asked me, "How did you get into a mess like this?". "Just lucky, I guess," was my reply.

"Great balls of fire," exclaimed the WC, "Ask him how damn many more messages he has." When the reply came back, "A stack six inches high," the WC said to me, "Tell him to stand by; I'm going to cut him through to Minneapolis."

In those days, telegraph operators throughout the whole state of North Dakota could light the red pilot lights of all eighteen telegraph circuits tied into the Fargo office of Western Union. During evening hours, by sending the right combination of long dashes, telegraph operators could cause selective relays to turn on the red lights tied into the Fargo office. Three Fargo telegraphers took turns answering these lights by plugging into the proper jack. Usually, each calling station sent only one or two telegrams.

When an operator had finished copying from a station, he could return to the north end of the long Western Union traffic room. We three operators spent our time there when we were not busy copying North Dakota's messages—telling stories and lying to each other about how many months it had been since we had *broken*. To break, in American Morse telegraphy, means breaking the circuit by opening the key switch to ask the sending operator to repeat a word. It is a matter of great personal pride for any telegraph operator to be able to copy for a long time without breaking, whether one is a landline or a radiotelegraph operator.

Commercial telegraph operators often used the code eight hours a day, seven days a week. With the passage of years, code became as natural as the English language so that, indeed, weeks or months could pass without the necessity of a break.

In my case, I received thirteen hours a day of code practice. I worked an eight-hour shift during the daytime for the Great Northern Railway. Each evening I reported at 7 PM to the Fargo Western Union office for an additional five-hour shift. The telegraphy trade refers to such moonlighting as scoop-

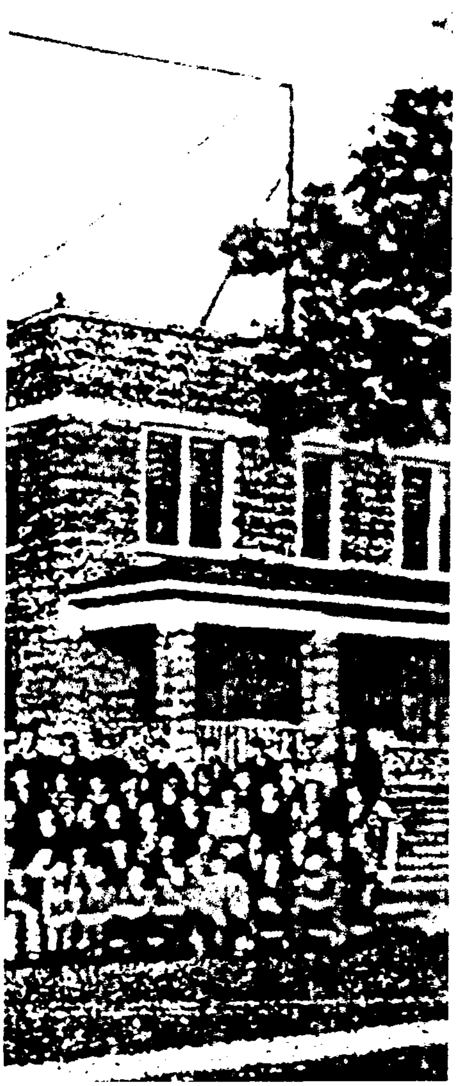


Photo B. Annual meeting of the Southern California chapter of the Morse Telegraph Club. The author is seated. Samuel F.B. Morse stands behind the author on his right.

ing. In short, neither I nor my co-workers at the Western Union office in Fargo ever needed to break.

Unless, of course, we were copying from the *World Champion of Rotten Morse*, a railroad agent in eastern North Dakota nicknamed Frenchy. In one master stroke of genius he simplified the American Morse code. Frenchy considered two dots to be a very nice code character—so he used two dots to represent all of the following letters: A, C, I, O, S, U and sometimes W. This made perfect sense to Frenchy but not much to those operators who had to copy his unique style of telegraphy. I once heard the late John Atkinson, wire chief for the Great Northern Railway at Minot, North Dakota, use the railroad telephone to call Frenchy after a frustrating twenty minutes of deciphering his code. "Damn you, Frenchy, you have sent me your message five times now and every time you send it you send it differently. Now give it to me here on the phone and stay off the telegraph wires."

The nickname Frenchy for poor practioners of telegraphy took hold. In the extreme western section of North Dakota another Frenchy emerged who was also a railroad agent. He matched the eastern Frenchy's ineptitude with American Morse telegraphy.

The immediate supervisor of the western Frenchy was a train dispatcher located in Enderlin, North Dakota. He was a high-strung individual who became extremely excited and nervous when placed under stress. For anyone in the profession of dispatching trains, this is a poor personality trait. He kept a box of baking soda right on his desk, together with a glass of water and a teaspoon in order to combat the large quantities of hydrochloric acid, which his vagus nerve constantly generated. The western end of the Soo Line Railroad, which he supervised, had no telephone lines. Therefore, his only means of communicating with Frenchy was over the number 8 iron telegraph wire extending from Enderlin to Frenchy's depot. Another dispatcher in charge of Soo Line trains east of Enderlin sat directly across a so-called double desk from the nervous one.

On one occasion, the western dispatcher desperately needed Frenchy's services, since two trains were to meet at his station. Unfortunately, instead of being on duty at the depot, Frenchy was at the local beer tavern attempting to add the title of local pool champion to his notariety as the co-champion world's worst telegrapher.

Meanwhile, back at the nerve center of the railroad in Enderlin, the systolic blood pressure of the western dispatcher increased alarmingly, and his consumption of baking soda reached an all-time high. The dispatcher seated across the desk became concerned. As the pool championship wore on, the nervous dispatcher had plenty of time to compose in his mind just what he would say to dress down Frenchy in Morse code.

The AWOL telegrapher finally did return to his depot, and the dispatcher telegraphed a two-minute lecture to Frenchy—expectedly vitriolic and uncomplimentary.

Frenchy made a perfect reply—a question mark. In American Morse code, the question mark conveys the meaning of "I don't understand" what the sending operator has just transmitted. When Frenchy sent the question mark, the eastern dispatcher said later that he was positive that his nervous co-worker nearly suffered a stroke.

(Part 2 of *Memoirs of a Former Telegrapher* will follow next month.)

Dr. William C. Hess, W6CK, lives in Pasadena CA (PO Box 191M). He presided over the North Dakota depot of Woburn, a tiny village in North Dakota, from 1937 through 1942.

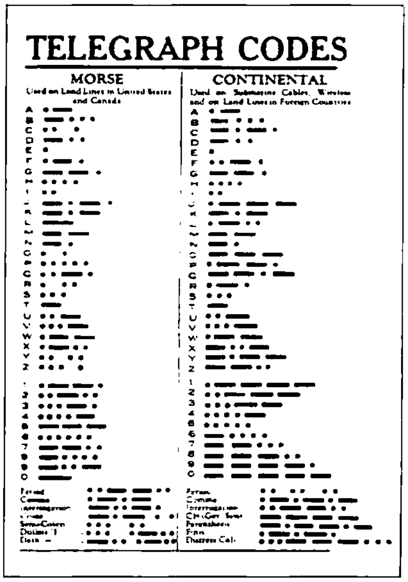
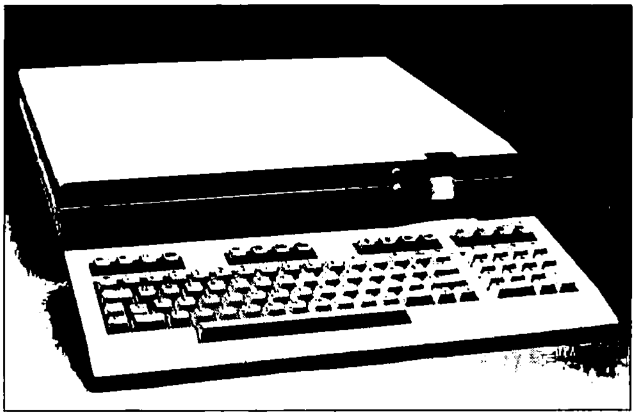


Fig. 1. Morse telegraph codes: United States and continental versions.

Number 14 on your Feedback card

NEW PRODUCTS

Compiled by Rebecca Niemela



Commodore's 128D Integral Personal Computer.

COMMODORE

There's something new at Commodore—the **Commodore 128D Integral Personal Computer.** Built-in 1571-compatible Fast Disk Drive with 128K RAM for advanced applications, saves time and increases productivity. It has a 92-key, detachable keyboard with flexible cord for easy input. The user can select 40/80 column full-color output or 512K for rapid data access with RAM expansion module.

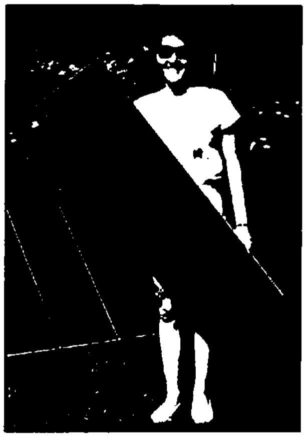
The Commodore 128D runs off-the-shelf CP/M® software such as WordStar,® dBase II,® and The Perfect Series®. It is also compatible with the Commodore 64 software and peripherals. The 128D has a suggested list price of $600.

And if you would like more information about the Commodore 128D either contact your local Commodore Dealer or write to Commodore Business Machines, 1200 Wilson Dr., Westchester PA 19380 (215/431-9100). Or circle Reader Service Card #202.

ANTENNAS WEST

Antennas West announces the introduction of its **QRV-SOLAR 23 Solar Power Supply** designed specifically to provide mains-independent power for remote repeaters, portable or RV-based stations, and home amateur radio installations. The heart of the system is an easily-installed unbreakable and bullet-tested solar panel with unique linear current boosting circuitry. The QRV-SOLAR 23, rated at 23 Watts, delivers 1.65 Amperes at 14 Volts and increased current at lower voltages. In a typical repeater installation, a single QRV-SOLAR 23 will support normal 24-hour usage while maintaining a full charge on the battery.

In a home installation with a standard 100-Watt HF transceiver, one QRV-SOLAR 23 generates enough power to support 15 hours per week of normal CW or SSB operation—or a full 24-hour contest binge every two weeks. Additional ORV SOLAR 23 panels can be wired in parallel to generate more power, and different styles and schedules of operation can be supported by chosing a battery with the appropriate capacity for the intended use. An extensive technical manual explains optional mounting methods, battery selection, panel connection and orientation and angle adjustment for maximum power efficiency.



Antennas West announces the QRV-Solar 23 Solar Power Supply.

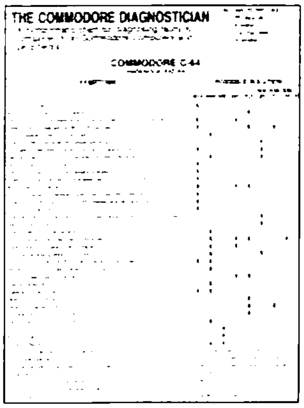
The QRV-SOLAR 23 is available for immediate delivery from Antennas West at $200 postpaid. An optional kit for mounting on vertical masts is available at $30.

For more information contact Antennas West, 1971 N. Oak Lane 1300 E., Provo UT 84604-2138 (801/374-1084). Or circle Reader Service Card #204.

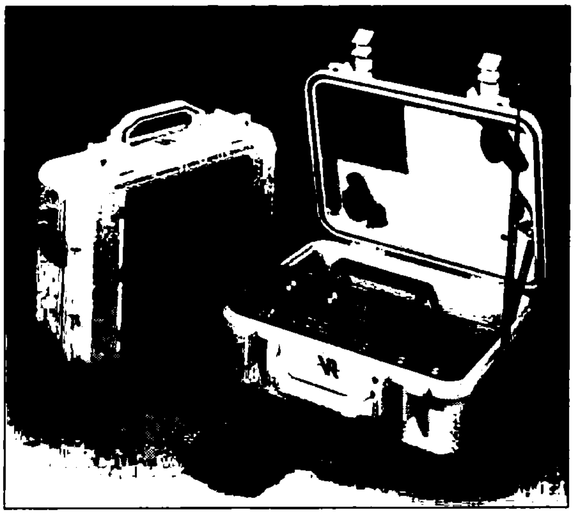
KASARA MICROSYSTEMS

Newly released from Kasara Microsystems is the **Commodore Diagnostician**. It allows the average Commodore computer user to diagnose and fix their machine when it's broken 95% of the time. The Diagnostician is inexpensive and would certainly be of value to the ham operator. It sells for $7 plus $1 shipping and handling. (Other Diagnosticians to be released soon: IBM Diagnostician, 1 and 2.)

For further information contact Kasara Microsystems, 33 Murray Hill Drive, Spring Valley NY 10977



Commodore Diagnostic Chart from Kasara.



VECTOR RADIO

Yachtsmen who are hams, long-distance sailors, cruisers, ocean racers, commercial fishermen, and boatmen who want guaranteed survival communications in the event of emergencies have been waiting decades for the appearance of something like the new **Vector Radio VR-50 Transceiver.**

The **VR**-50 is powered by a rechargeable battery which is maintained at full charge by a photovoltaic solar panel on top ol its waterproof floating case. The high-visibility impact-proof case is made of tough plastic with scuba-type "O" rings. It takes up a mere ½ cubic foot and measures only 14" x 11" x 6" with a weight of only 16 pounds. The 8-foot telescoping whip antenna stores inside the case when not in use. An internal antenna-tuner which matches the antenna is built into the set. The VR-50 may be used with a wide range of auxiliary antennas.

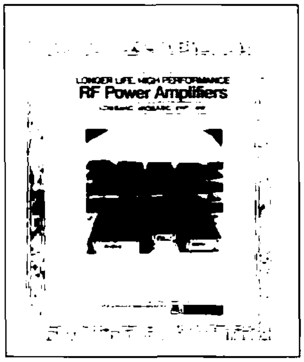
The remarkable new "around-the-world" radio puts out 50 Watts PEP (peak envelope power) on voice and 25 Watts on CW (code). The set is crystal controlled for "on the money" tuning of a total of 24 channels in the 1.8 to 17 Megahertz short, medium, and long distance bands.

The **VR**-50 sells for $1,300 and is manufactured by *Vector Radio Company, 3207 Roymar Rd., Oceanside CA 92054; (619/722-4099). Or circle Reader Service Card #203.*

(914/356-3131) or circle Reader Service Card #208.*

ANTENNA SPECIALISTS

A new 4-page bulletin, #RFA-4001, describing the company's newly-designed line of RF power amplifiers is available from the Antenna Specialists Co. Complete performance specifications and typical output-vs.-input power graphs on each of ten models are presented. The line comprises three VHF models covering 144-174 MHz; four models covering 432-512 MHz UHF band; and three additional export models operating in the midband frequency range. State-of-the-art micro-strip matching and filtering, relay T/R switch for minimal insertion loss, and full protection against DC polarity reversal and high VSWR are characteristic of the complete line. To receive a copy of the FREE bulletin, contact: The Antenna Specialists Company, 30500 Bruce Industrial Parkway, Cleveland OH 44139-3996. Or circle Reader Service Card #210.



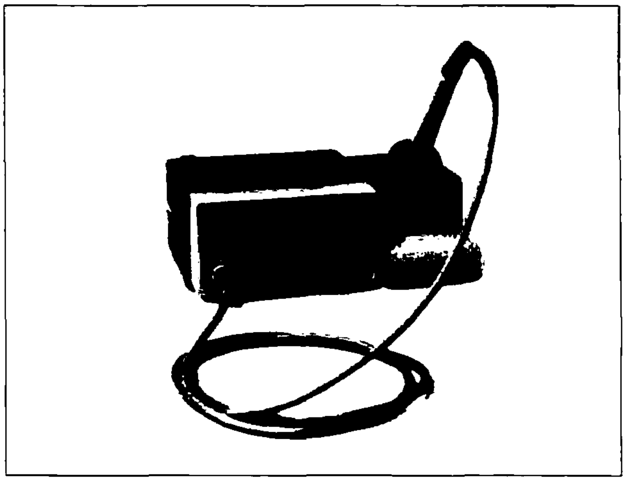
Antenna Specialist RF Amplifiers

MINK IMPORT-EXPORT

The German-made **ERSA MS 6000** electronic soldering station, long popular in Europe, is now available in the United States. The ample power supply (60VA) and the TE 40 iron with a novel position temperature coefficient (PTC) heating element permit a large field of applications. They range from the most delicate operations to operations for which uncontrolled irons of up to 100 W have been used. The high-energy reserve of the PTC heating element and the transformer provide a virtually constant soldering temperture even in rapid soldering sequences. The unit features a 60-second heat-up time.

The safety-insulated electronic control unit includes a 110/24V transformer and is continuously variable for tip temperatures between 300 and 840 degrees Fahrenheit. The heater-windings of the soldering iron also serve as a temperature setting. By means of zero voltage circuits and a Triac, the heating element is supplied with energy and the operating state is indicated by a red light-emitting diode. The soldering tip is connected with the level potential terminal through a high Ohm resistor. The price class for the **ERSA** 3000 is $120. Five tips are available for $4.

For additional information contact Robert W. Mink Import-Export Inc., PO Box 6437, Fair Haven NJ 07704 (201/758-8838) or circle Reader Service Card #214.

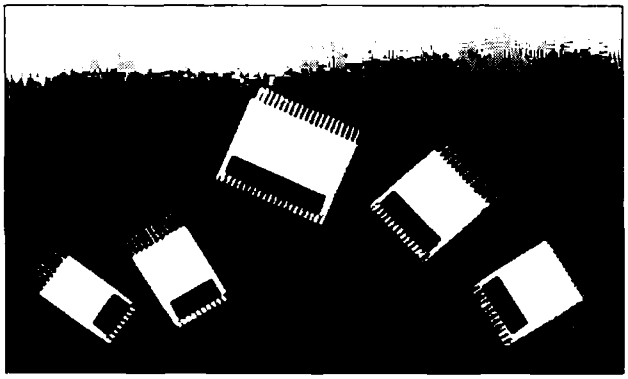


Mink Soldering Station, ERSA MS 6000.

DAVLE TECH

The Model **A-TEK IC test clip** is designed to facilitate temporary connections to the dual-in line packaged components in conjunction with a number of test instruments for power on/hands off circuit testing. There are many types of test clips available: a 16 pin, 20 pin, 24 pin and 40 pin. Standard DIP spacing, gold plated contacts, low contact resistance, less than 1 mili-Ohm at 1 KHz.

For more information contact Davle Tech Inc. 2-05 Banta Place, Fair Lawn NJ 07410 (201/796-1720) or circle Reader Service #215.



Davle Tech's A-TEK IC Test Clip.

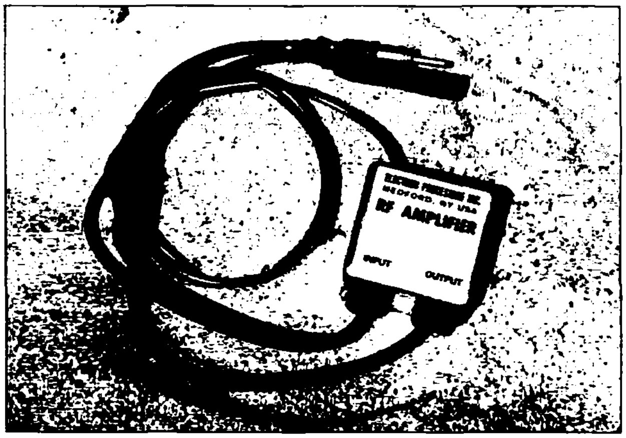
ELECTRON PROCESSING

Electron Processing announced the addition of two new models in their product line of Signal Intensifier™ RF amplifiers.

New series **RFC Signal Intensifiers** are 12 volt dc powered versions of their popular RFA series. These low-cost yet high performance receiver preamplifiers are ruggedly made for lasting performance in the grueling environment of today's automobiles.

Available in two versions, the RFC-30 covers 500 KHz to 150 MHz and the RFC-16 covering 50 MHz to 1000 MHz. Both amplifiers provide 13 dB gain and are supplied with convenient Motorola connectors. Power required is approximately 25 mA at 10 to 18 volts dc, negative ground. Pricing starts at $30 Amateur Net with quantity discounts available.

For more details and ordering information, contact the Sales Department, Electron Processing, Inc., P.O. Box 708, Medford NY 11763 (516/764-9798). Or circle Reader Service Card #205.



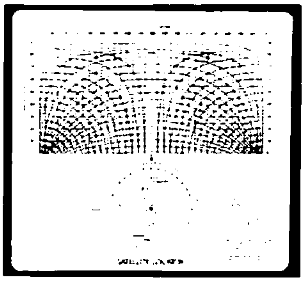
Electron Processing's RFC Signal Intensifier.

ADVANCED RADIO DEVICES

Two years in development the 230A represents a new dimension in linear **amplifier** technology and operating convenience. The 230A provides maximum legal power on all amateur bands with no time limit. The drive frequency is continuously monitored by the processor and adjustments made to ensure maximum amplifier output at all times.

Introductory price for the 230A is $3,650 (Made in the USA).

For more information contact Advance Radio Devices, 103 Carpenter Drive, Sterling VA 22170 (703/478-3100) or circle Reader Service Card #211.



The Satellite Locator, a WTS product.

THE SATELLITE LOCATOR

The Satellite Locator is a slide rule that gives azimuth/elevation angles to geosynchronous satellites from almost anywhere on earth. On the slide rule there are visual representations of the full satellite arc—horizon-to-horizon, around the world, even from the southern hemisphere—with local azimuth and elevation angles. It also gives the U.S. satellite longitude positions, a magnetic declination map of the U.S., a true-to-magnetic azimuth conversion slide rule and handy az-el formulas.

This device allows the quick determination of az-el angles from anywhere on earth that the satellite arc is visible. A magnetic declination map and a true/magnetic slide rule on the back allows the true azimuth to be converted to local magnetic azimuth. The az-el formulas are also printed on the back to allow more precise angle computation with a portable calculator.

The price for the Satellite Locator is $10. Shipping is included and quantity rates are available.

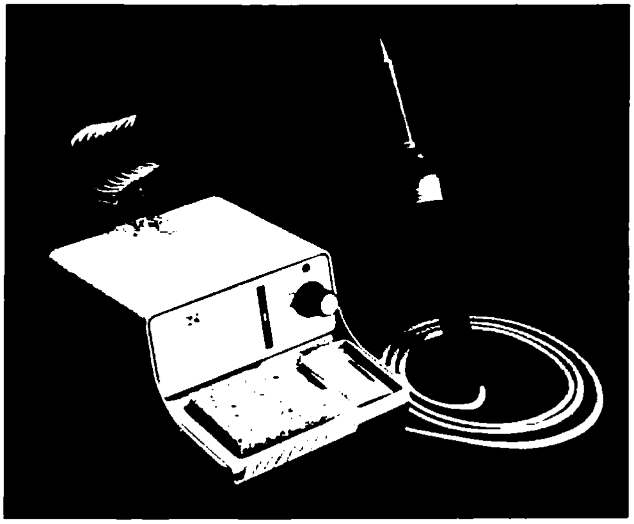
For more information, please contact WTS Products, 4308 South Peoria Suite 681, Tulsa OK 74105, or circle Reader Service Card #206.

SUPERTEMP XY7

The SUPERTEMP XY7 soldering stations offer controlled temperature hand soldering. Fixed temperatures are selectable by rotating the switch. A unique electronic control circuit maintains tip temperature to within ± 3°C (6°F). This is accomplished by embedding the thermocouple sensing unit in the bevel of the heating element barrel so that the tip actually seats against it. This method allows the closest possible monitoring of tip working surface temperature.

The specially insulated NICHROME wire heating element is compressed between two layers of stainless steel for ruggedness and is located at the end of the barrel to insure instant heat up and recovery. The revolutionary electronic "Zero Voltage" switching protects voltage and current-sensitive devices such as CMOS against transient voltage spikes caused in stations. The soldering tip is grounded through the power unit to insure the tip leakage is less than 0.4 millivolt or 0.03 microampere.

Additional information is available from Davie Tech Inc., 2-05 Banta Place, Fair Lawn NJ 07410 (201/796-1720) or circle Reader Service Card #213.



Supertemp XY7 from Davle.

NEW VECTOR SMT TRAINING KIT

Jensen Tools has designed a kit to give electronic engineers and technicians a working knowledge of materials and methods to use with Surface Mount (SMT) semiconductor assembly technology.

The kit contains SMT devices, prototyping boards, component attachment and interconnection materials and a comprehensive 50-page instruction manual. Included are 270 capacitors, 300 resistors, 10 diodes, 10 transistors, 5 different ready-to-use double-sided circuit boards with layout/planning sheets, a single-sided board with six PLCC patterns, two-part conductive adhesive that cures at room temperature, solder paste with dispenser needles, solder wire, solder removal braid, 1 plastic and 1 stainless steel tweezers, and pins for piggyback mounting of finished PC boards on larger circuit boards.

The illustrated "Guide to SMT" manual contains detailed instructions on attaching and removing SMT devices.

For more information write or call Jensen Tools, 7815 S. 46th Street, Phoenix AZ 85044 (602/968-6231) or circle Reader Service Card #208.

Vector SMT Training Kit by Jensen Tool.

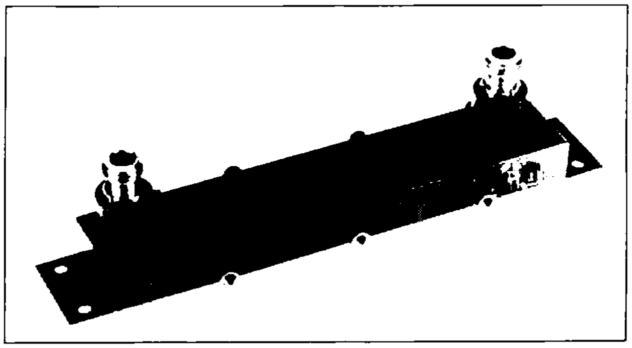
WIDEBAND ENG BANDPASS FILTER

Microwave Filter Company, Inc., has come out with a new wideband ENG bandpass filter. Model 5348 bandpass filter has a flat passband of 26 MHz in the remote pick-up ENG band (1990-2110 MHz). It has high selectivity to isolate several contiguous channels.

The 5348 has an insertion loss less than 1.5 dB with a 3 dB roll-up bandwidth greater than 26 MHz. The center frequency is a customer option. Selectivity is 30 dB minimum at ± 23 MHz. Impedance is 50 Ohms and connectors are type N. The base plate is 1.5 x 9 inches and has mounting provisions.

Price is $445 and delivery is 30 days.

For more information contact Microwave Filter Company, Inc., 6743 Kinne Street, East Syracuse NY 13057 (800/448-1666) or circle Reader Service Card #209.



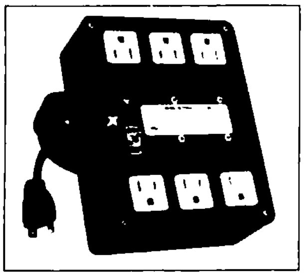
Wideband ENG Bandpass Filter from Microwave.

POWER FAIL INTERRUPT

Electronic Specialists has expanded their equipment protection line to include filter/suppressors and 20/30 Amp protective devices.

The power fail interrupt can now be ordered as an adjunct to all Electronic Specialists' power conditioning equipment. Option price is $95 installed.

For more information write to Electronic Specialists, Inc., 171 South Main Street, Natick MA 01760 (800/225-4876) or circle Reader Service Card #203.



Power/fail/interrupt by Electronic Specialists.

Never Say Die

Continued from p. 6

able for readers is for them to provide more interaction between readers. When it comes to a review of a piece of new ham gear I'd rather know what ten fairly average hams who've bought it think of it than to read one engineer's opinion.

Now that about 70% of you have computers you should at least be able to write letters to *73* without having to tear pages from a spiral notebook and scribble with a blunt pencil. So let's get started coping with the Information Age. What ham gear have you bought recently? How has it been to use? Have you had any problems with it? Has the manufacturer or importer been cooperative? How about your ham dealer? How easy was it to get fired up? What features do you like about it? What don't you like? Do you recommend that others get one too? What can you tell them to help them get better use from it? Have you any suggestions to the manufacturer on ways to improve future models? What features would you like to see? How about the price?

I'm not going to feel comfortable that *73* is doing what it should until we've published at least two or three reader reviews of every piece of ham gear I'm likely to find advertised in the magazine.

So let's see what you think of any new gear you've bought. Fire up your word processor, put in the dictionary disk and have at it. Send me the print-out and a floppy, either 3" or 5" so I won't have to make someone sit and retype your review.

One practical matter you should keep in mind...the thickness of *73* depends entirely on how many pages of advertising we have, so let's not go out of our way to be nasty. No, I'm not saying you should lie or distort your facts—just don't get carried away with negatives.

Most of the letters I get are wonderful, but every now and then I get a nasty one. Yes, I realize that I'm probably not being singled out for the nasty attack—that this poor chap is inflicting the same lousy treatment on his wife, family and business associates. So I sigh sadly when I get rotten letters and try not to get mad in return.

We're getting more advertising in *73*—with some very satisfying success stories from several advertisers. The more pages of ads we have, the more magazine you'll get every month. The percentage of ads should run about 50% these days. It used to run about 30%, but when one of the ham magazines went to 50% and thus cut their advertising rates accordingly, the other ham magazines had to follow suit.

Sure, you can help make *73* fatter. Sending in the Reader's Service card asking for information about advertised products helps. Mentioning *73* when you write advertisers helps. Buying the products advertised in *73* is the biggest boost of all.

Problems with Products?

By the way, if you ever run into any problems with the products or services of a *73* advertiser, please be sure to let me know about it. I'm by far the most picky of the ham publishers when it comes to accepting advertising. What you do is this: write a detailed letter giving the facts of your complaint—just the facts, without all the invective is the best approach—send the letter to the firm with a note on the bottom that a copy is going to Wayne Green. This usually does wonders at getting their attention. You can be sure that my staff will be asking questions of this firm. Please don't embarrass me by exaggerating or distorting the facts, okay?

> ***"The chap who builds just hates to write, so maybe you can collaborate with him"***

This system has worked wonders down through the years. I've helped get some dishonest ham advertisers convicted and jailed—and I've steered readers away from many ripoffs. But I need to get early warnings from you.

You know, if we can get a few more advertisers back into *73* we can put out those big fat issues we used to a few years ago. So how about helping the manufacturers out? If you get a piece of gear you think everyone ought to know about, write it up. If you find a ham dealer who goes out of his way to help you, help him back with a writeup I can publish in *73*. This is the Information Age! Or at least it will be if you'll stop sitting on information and break loose. Wouldn't you like to see your name and call in print? What a feeling that is! You'll be absolutely astounded at how many of your friends will spot it and how often chaps will mention seeing your piece when you work them.

What else? Well, the *73* readers seem to agree just about 100%—they want to see short construction projects in the magazine. If you've got someone in your area or in your club who likes to build gadgets, see what you can do to get them to write 'em up for us. Or, as is so often the case, the chap who builds just hates to write, so maybe you can collaborate with him and get both your names in print. There are some hams who love to write and are remarkable in their ability to find non-writing ham builders to promote.

I sure wish there was someone who could translate some of the Japanese ham magazine construction projects into English. They have more stuff in their ham magazines every month than I'm able to get here in a year. There's nothing like having about five times as many hams—and most of them youngsters—to develop an interest in building. Of course they have an enormous advantage over us in getting parts. They can shop at the hundreds of small parts shops in the Akihabara section of Tokyo. If you visit there you'll see thousands of kids eagerly buying parts, chips and circuit boards.

Indeed, few parts are made in America any more, so we're almost entirely dependent on imported parts. When our consumer electronic industries all moved their manufacturing to Japan, so did the parts companies that supplied them. Even the companies making the machines to make the parts are out of business now, so we've a long row to hoe before we can rebuild America's electronic industries. Oh well, you've read all that many times before—it rankles me, so I won't let go. So let's get started coping with the Information Age. Let me know how we can improve the index. Start writing your impressions of new ham gear. You might even write if you have any experiences or ideas which others might find of value—like how to get ham clubs started or rebuilt—how to get school radio clubs going—how to attract youngsters to our great hobby.

73 is a communications medium, so start communicating.

The Hamvention

The word is that I'll be speaking again on Saturday afternoon at Dayton. Bring something to eat and a cushion—they've allocated three hours! But that brings up the question—what would you like me to talk about? I've been giving the same talk for the last two years about how amateur radio needs growth. I don't want to play the same old record every year.

Would you be interested in my going into some of the new communications technologies amateurs should be pioneering? Is anyone interested in a historical perspective of our hobby? I've been a ham for almost 50 years now, and I've been a ham editor/publisher for 37 of those years, so you aren't going to find anyone with a broader perspective.

Or is there some interest in how to use your amateur radio interest to make money—either as a side line or even as a business? I'm a big fan of taking advantage of technology to start small firms and get rich. Indeed, I've helped thousands of small firms grow into million dollar size over the years.

I'll talk about anything you want, so please drop me a line with your ideas. If you're interested in DXing I might talk about some of the more interesting countries I've visited. You know, it really isn't all that expensive to travel as a ham, so perhaps you're missing some fun.

You want me to talk about UHF and my working seven states on 10 GHz? As far as I know, no one has come close to my record yet.

Or perhaps you'd like to have some ideas on ways to make your ham club grow and be more fun—ways to attract potential Novices—ways to help Novices get on the air at low cost and still have a ball. How about cross-banding repeaters to make it possible for Novices to work some 20m DX?

Please advise.

73 Book Review

Essential References for the Builder

Two circuit collections from Harry Helms

reviewed by Larry Antonuk WB9RRT

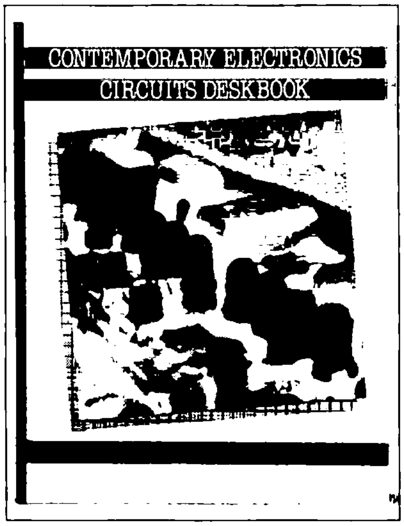
Contemporary Electronics Circuits Deskbook
McGraw-Hill Book Company 1986
Hardbound, 253 Pages (Illustrated)

Existing circuit anthologies suffer from two major drawbacks. First, they are filled with less-than-useful circuits: It may be fun to know how a rain detector works, but I'll just keep looking out the window. Second, once you find a circuit that fits your needs, you discover that it was pulled from a ten-year-old magazine. All the part numbers produce nothing but blank stares down at Radio Shack. You decide to build the gadget anyway, substituting a chip and a transistor or two. It doesn't work. Was it a wiring error? The substitutions weren't valid? Or maybe the circuit wasn't correct in the first place?

The *Contemporary Electronics Circuits Deskbook* overcomes both of these problems quite nicely, at least as far as the ham radio operator is concerned. Drawing mainly on past issues of *QST*, *73 Magazine*, and *Ham Radio*, the *Deskbook* is filled with circuits that are ham radio oriented, or would at least interest hams. To round things out, the book includes sections on audio, automotive, video, timers, and, of course, popular miscellaneous circuits. In addition, most of the circuits are from 1983 or later, which ensures that the chips and transistors have friendly, familiar numbers on them.

The table of contents lists 28 categories, which cover practically every aspect of electronics. Some of the sections are rather slim, notably Automotive and Optoelectronics. Most of the categories, however, are quite comprehensive—containing fifteen to twenty separate circuits. The most-used chapters will probably be Interfacing (just how do I drive TTL with CMOS??) and Power Supplies (how to hook up all those regulator chips).

Rather complex circuits take up a fair amount of space in the book, which is not necessary. No home hobbyist will whip up a fourteen-IC Digital Multimeter on the basis of one schematic found in a circuit collection. He wants theory of operation, PC board layouts, pictorials, parts sources, etc. This isn't a major problem, though, since the source of the circuit is listed with each diagram. If a particular circuit seems especially interesting, that back issue of *73 Magazine* (or whatever) can be pulled out for a complete description.



Weighing in at $30 for the hardcover edition, the *Contemporary Electronics Circuits Deskbook* is somewhat of a heavyweight. For those folks with the last seventeen years of *73*, *QST*, and *Ham Radio* in their garage, the book may not be much of a bargain. But with those of us who keep our electronics library stored in a milk crate, the *Deskbook* is a good investment both as a reference book and for casual browsing.

Handbook of Practical IC Circuits
Prentice-Hall 1987
Hardbound, 160 pages (Illustrated)

Handbook of Practical IC Circuits is a tribute to the integrated circuit whose arrival undoubtedly constitutes the single most significant event in the history of hobbyist electronics. This phenomenon has changed the whole approach to home building. Need a timer? No need to lash together a handful of transistors—just tie a cap and a few resistors to a 555 and you're in business. The time usually spent on debugging can be put toward further testing or experimentation. (As a comparison of time saved by using ICs, think of building the equivalent of a 741 op-amp with tubes!) For the most part, hobby electronics now consists of hooking up various "building blocks" to get the desired result.

So where does one go to get the information needed to work with ICs? Obviously, all the manufacturers publish data sheets and application notes, but these are often too complex, and the circuits too sketchy. Circuit "cookbooks" are fine, as long as they have just what you want listed. If you need a slightly different circuit, or if things don't work when you plug them in, you're in trouble. The *Handbook of Practical IC Circuits* gives the builder a comfortable blend of circuit explanation and already-debugged circuits. Should the reader need a variation of one of the circuits listed, the accompanying text gives enough explanation so the changes can be successfully made.

The handbook can be used as a reference guide when designing a specific type of circuit, or it can be read as a tutorial. The circuits all use commonly available parts—a handful of ICs, a prototype board, and a power supply will turn the book into a beginner's course on basic IC technology. Helms has written the book in a light, readable style that makes reading about shift registers interesting (almost).

The *Handbook of Practical IC Circuits* is wrapped up with a short interfacing and troubleshooting section. The troubleshooting section contains this gem: "Blame Yourself First and the IC Last." (Repeat this five times if something you've built doesn't work.) The integrated circuit, in addition to being extremely easy to use, is very reliable. Between the reliability of the ICs and the solid information contained in this handbook, it shouldn't be necessary to blame anyone—your circuits should all work the first time around!

Tool a Transmitter for AM Broadcast

Get a license-free slice of the spectrum

by Ken Cornell W2IMB

A beautiful 105 kHz slice of spectrum is available to experimenters with this simple, crystal-controlled transmitter. FCC rules governing nonlicensed transmitters offer some helpful information. A brief look at the history of the FCC rules governing nonlicensed transmitters (Part 15 Section 15:113) reveals that anyone can operate in the 510 to 1705 kHz range within certain limitations. In lieu of meeting the requirements of Section 15:111, a low-power communication device may operate on any frequency in the band 510–1705 kHz provided it meets all the following conditions.

(a) The power input to the final radio stage (excluding filament or heater power) does not exceed 100 milliwatts.

(b) The emissions below 510 kHz or above 1705 are suppressed 20 dB or more below the unmodulated carrier.

(c) The total length of the transmission, the antenna, plus the ground lead (if used) does not exceed 3 meters.

(d) Low-power communication devices that obtain their power from the lines of public utility systems shall limit the radio frequency voltage appearing on each power line to 200 microvolts or less on any frequency from 510 to 1705 kHz. Measurements shall be made from power line to ground with the equipment grounded and ungrounded.

Don't Give Up

In reading the above regulations, the first thought might be, "What chance would a transmitter running a tenth of a watt with a 10-foot antenna have against those high-powered broadcast stations?"

While it does sound discouraging, take a second look! The low end of the broadcast band ends at 540 kHz, this leaves the 510 to 540 kHz range relatively free of interference. At the high end, the present BC band stops at 1600 kHz leaving the range of 1600 and 1705 kHz fairly free of interference. Eventually this portion will be occupied by the expanded BC Band, but for the time being, it is a beautiful 105 kHz slice of spectrum!

Operation in the occupied portion of the band is strictly an area problem. Stations are separated by 10 kHz, and some stations do not operate 24 hours a day, or they operate with reduced power at night—so it is possible to find a few clear spots.

Eight years ago I ran a beacon on 1575 kHz with a transmitter made from a couple of bipolar transistors. My best DX was reception at 18 miles with Q5 copy. I am sure that my signal didn't "drop dead" a few feet further on!

The transmitter discussed here uses a simple, foolproof circuit with a couple of cheap ICs and a power VMOS, MOS or HEXFET RF amplifier. Using crystal control, there is only one tuned circuit: the tank/antenna coil. Another coil can adapt the oscillator circuit to VFO control.

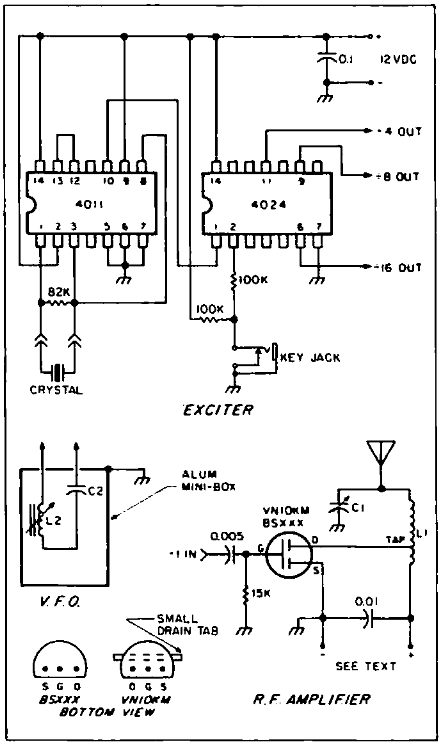


Figure 1. Medium frequency transmitter. NOTE: All resistors are ¼ watt rating and capacitors, 50 volts.

The circuit uses a CMOS 4011 IC as the oscillator. This is followed by a CMOS 4024 IC as a frequency divider, which permits the use of cheap, high frequency crystals. The final amplifier uses a Power MOS BS170, a Siliconix VN10KM, or International Rectifiers HEXFETs in the lower power IRFXXX series.

For operation on the 510 to 540 kHz range, use the divide by 16 output from the 4024—and for the 1600 to 1705 kHz portion, the divide by 4 output. See Table 1 for other available divided frequency outputs available.

The complete transmitter circuit is shown in Figure 1 with a suggested parts layout in Figure 2. All parts were mounted on a 2½" x 5" IC perforated board (holes spaced .100" x .100"), and sockets were used for the solid state devices. Since the circuit does not involve very high frequencies, simple point-to-point wiring will suffice.

Wind and Bolt

Plastic pill bottles 1⅝" diameter x 2½" deep make suitable coil forms. The snap-on covers for the bottles bolt to one end of the perfboard. For the low end of the band, wind 210 turns of #30 enameled wire with the drain tap at 30 turns from the plus feed end. For the high end of the band wind 70 turns of #24 enameled wire with a tap at 10 turns. Drill two small holes side by side at each end of the coil form to secure the ends of windings. For mid-range, the number of turns can be evaluated by the two coils described; however, the drain tap must be 1.7th of the total from the plus feed end.

Since the 3m antenna connected to the end of the coil has minimal capacity to its ground system, a variable capacitor is required between the antenna connection and ground.

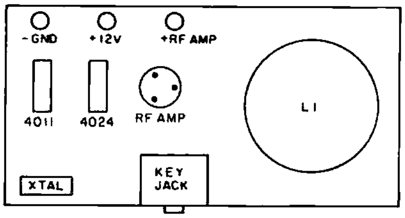


Figure 2. Layout of parts.

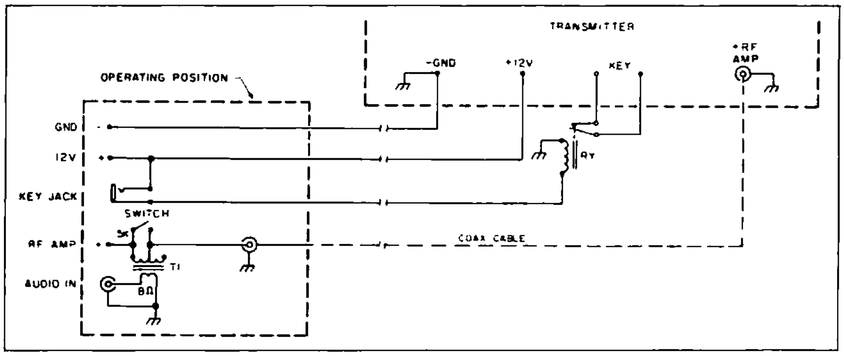


Figure 3. Remote control wiring. RY... 12 volt DC relay with normally closed contacts (SPDT can be used) T1... Audio output transformer.

In Section 15:133 the FCC requires that the following notice be placed on home-built transmitters:

I have constructed this device for my own use. I have tested it and certify that it complies to the FCC Rules Part 15. A copy of my measurements is in my possession and is available for inspection.

Signature____________________________ Date ______________

Figure 4. FCC Mandatory Notice.

A 50pF trimmer capacitor will work fine.

Initial Tests

After assembly completion and wiring double checks, apply 12 volts to the exciter only (the two ICs) and clip a short length of wire to pin #10 on the 4011. Tune a receiver in CW position to the crystal fundamental frequency, and a loud beat note should be audible. Next, clip the wire to the desired divided frequency output and tune the receiver to the same frequency. Again, a beat note should be audible. If no audible beat notes occur, recheck the wiring and particularly all solder connections.

With the exciter operational, next check the entire transmitter. Connect the antenna, insert a VOM with a 50 milliampere range in series with the plus lead to the final amplifier, and feed about 5 to 6 volts to it. With the tank/antenna coil out of resonance, very little current will flow. Tune the coils' variable capacitor until the drain current rises as the circuit approaches resonance. Check the operational frequency with the signal strength meter on a receiver and tune for maximum signal strength. At this point, set voltage and current to 100 milliwatts. A field strength meter is a valuable tool for tuning up.

All Important Antenna

Location and construction of the 3-meter (9' 10⅛") antenna should command considerable attention. It should be in the clear and as far as possible away from trees and RF absorbing structures. Any supports should be well insulated. A good ground is desirable with radials or wire mesh, as well as a driven pipe. With the circuit shown, there is low and relatively harmless DC voltage on the antenna. A 0.1mF capacitor added at the antenna connection will eliminate this voltage.

Considering the broadcast interpretation of the FCC rules on the antenna size, I would consider any structure that can be confined within a 3m diameter by 3 meter high imaginary cylinder legal. The transmitter would be contained within or at the periphery of such a structure.

A self-supported antenna can be made from 6" diameter stove pipe with 3 angle brackets at the bottom supported on stand-off insulators. Paint the pipe with a good rust inhibitor. The transmitter, of course, would be placed in a weathertight housing. Due to the low power of such a transmitter, remote control of the transmitter is no major problem. See Figure 3 for a suggested arrangement.

VFO Operation

The 4011 can be used as a VFO by replacing the crystal with a slug tuned coil in series with a capacitor (see L2 & C2 in Figure 1). Sixty turns of #30 enameled wire wound on a 5.16" diameter slug tuned form in series with a 100 pF silver mica capacitor work well. A mini-box with an empty FT243 crystal holder at the end can serve as a mount. The coil and capacitor leads are not grounded to the mini-box and are connected to the crystal holder pins. This permits the VFO unit to be plugged into the crystal socket. A separate ground strap for the mini-box is provided for shielding. Using the slug for tuning, the VFO coil tunes 6030 to approximately 9,000 kHz which will cover the entire BC band using 4 to 16 divide positions. The 12 volts to the ICs should be regulated if a VFO is used. One advantage of using the divide by "X" circuit for a VFO is that any instability in the VFO is lessened by the division factor.

For AM modulation, I use a tube type audio output transformer with an 8Ω voice coil secondary. The primary (or ½ the primary if a push-pull type is used) is connected in series with the plus lead to the RF amplifier and the 8Ω output from a low power audio amplifier is connected to the 8Ω winding on the transformer.

For the power supply, I use standard handbook circuitry with a bridge rectifier, a 7812 for 12 volt regulation and a LM317T for variable voltage output from 2 to 24 volts for the RF amplifier.

To conclude, I might mention that I mounted the perf board containing the transmitter on short stand-offs on a larger piece of wood board to permit space for the notice that the FCC under Section 15:133 requires to be placed on all home-built devices. It also gives the transmitter some weight and stability.

While most of the common parts can be found at any well-stocked radio supply store, I suggest the following sources for hard to find components. Radio Shack-BS170 MOSFET (276-2074). Audio output transformer, 1k center tapped primary and 8Ω secondary (273-1380).

DIGI-KEY Corp., P.O. Box 677, Thief River Falls MN 56701-0677. 4011 & 4024 I.C.'s, sockets, IRF series of HEXFET's.

JAN Crystals, P.O. Box 06017, Fort Myers FL 33906-6017. FT243 crystals 2010 to 8900 kHz at $4.50 each. FT243 sockets at $.30 each. First Class mail and packing, add $.35 per crystal.

Operational Freq.	Crystal Freq.	Divided Freq.	4024 Pin No.
1600 x 4 =	6400	2	12
1705 x 4 =	6820	4	11
		8	9
510 x 16 =	8160	16	6
540 x 16 =	8640	32	5
		64	4
		128	3

Table 1. Typical crystal and resulting divided frequency values.

73 Review *by Jim Thompson W4THU*

Number 17 on your Feedback card

International Radio, Inc.'s 2.1 kHz SSB and 400 Hz CW Filters

International Radio, Inc.
747 South Macedo Blvd.
Port St. Lucie, Florida 33452
(305) 879-6868
Price class: $150/pair (either SSB or CW)

They get the job done.

The quality and performance of contemporary top-of-the-line transceivers leave little room for complaint. Top-notch performance requires triple and quadruple conversion schemes that use two or more filters for each mode of operation. The result is a marvelous arsenal of weapons for fighting QRM, but this weaponry is far from cheap. Because of the cost, most rigs include only basic filters.

Other companies beside transceiver manufacturers produce filters. International Radio offers SSB and CW filters in matched sets for most rigs. This review looks at a pair of International Radio's 2.1 kHz filters, which replace the standard 2.7 kHz filters in the Kenwood TS-930S. I also review here a set of 400 Hz filters from the same company.

A Few Basics

Multiple conversion schemes distribute filtering over several IF frequencies. There are sound technical reasons for this. In the TS-930, there are 4 IF frequencies. The signal frequency is up-converted to 44.93 MHz, which is followed by a 8.83 MHz IF. The third and fourth IF frequencies are 455 kHz and 100 kHz. Although there are filters at each IF frequency, the filters at 8.8 MHz and 455 kHz primarily determine the transceiver's IF response. An unmodified TS-930S has a high-quality 8.8 MHz IF crystal filter with a bandwidth of 2.7 kHz. The filter in the 455 kHz IF is a multi-pole ceramic filter. It's an excellent ceramic filter, but does not meet the standards of quality crystal filters.

Many casual CW operators don't install the optional CW filters available from Kenwood and others. They opt instead for the built-in audio filter and the CW VBT control, which provides a CW bandwidth variable from 2.7 kHz down to 600 Hz. This system uses the standard SSB filters supplied with the transceiver.

Although receiver selectivity is 600 Hz wide at -6 dB, the skirt selectivity is poor. Serious CW operators want the performance available from optional CW filters.

Installation

International Radio's matched set of 400 Hz bandwidth CW filters don't plug in like Kenwood's own filters do. The installer must cut two pins on the transceiver's main circuit board and solder connections to the new 8.8 MHz filter.

Since the insertion loss of the International Radio filters is slightly higher than Kenwood's filters, I measured receiver sensitivity to check for any degradation. With the International Radio 8.8 MHz CW filter installed, a 70µV signal yields an "S-9" meter reading and the MDS (minimum detectable signal) was less than 0.1µV (on 20m).

Installing the 455 kHz CW filter unit requires very careful soldering. This filter's location leaves little space in which to work.

After completing the installation of the 455 kHz filter, measurements were again taken, and the added insertion loss of the International Radio 455 kHz CW filter was +2 dB. The MDS remains in the 0.1µV range.

The International Radio 400 Hz CW filters work very well. The skirt selectivity is good, and there is no ringing. Figure 1 illustrates the bandwidth available at various settings of the CW VBT control. With this control set to the NARROW position, CW bandwidth is only about 100 Hz at -6dB and 400 Hz at -50 dB. However, since the TS-930S' CW VBT circuit is designed to work with 500 Hz filters, adjusting this control to its narrowest position (to attain the 100 Hz selectivity), will result in significant signal loss (greater than 15 dB). I found that setting the VBT no narrower than the 9 o'clock position produces a good compromise between signal loss and filter bandwidth.

Most of us relate to S-meter readings better

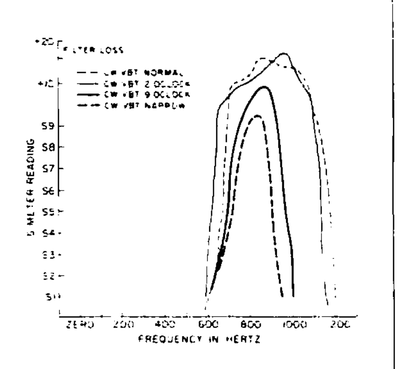


Figure 1. CW filter bandwidth at specific rotation points of VBT control.

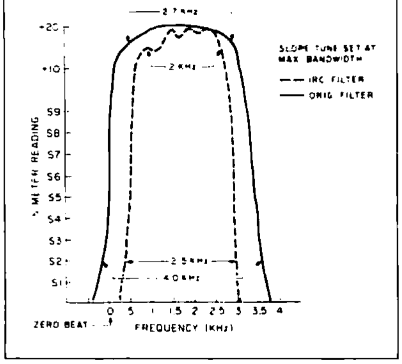


Figure 2. Slope tune, set at maximum bandwidth.

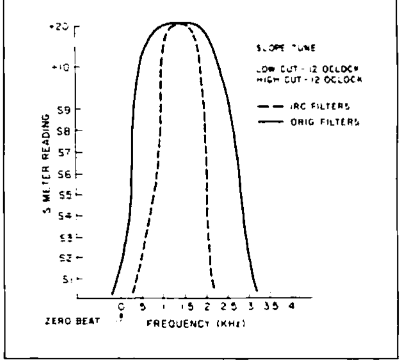


Figure 3. Slope tune, Low cut at 12 o'clock and high cut at 12 o'clock.

than a straight dB scale. The curves are referenced to the TS-930S' S-meter readings. These measurements can be without sophisticated test equipment. If you do not have a stable signal generator (a HP 8640C was used in this evaluation), you can use the 100 kHz calibrator as a signal source. Incidentally, with this particular rig, meter readings from "S-1" to 20 dB over "S-9" represent a range of about 50 dB.

I compared the original Kenwood filters with International Radio's replacements. I first installed a switching board, also available from International Radio. This board permits you to select either the original Kenwood SSB filters or the new filters while receiving. The transmission signal path is through the original Kenwood filters.

The Switching Board

Installing the SSB filters and switching board is a much more difficult task than installing the CW filters. It is not a plug-in and cut-a-jumper procedure. Since the original Kenwood filters remain in place, the new filters must find homes.

The switching board is not a necessity, and I recommend against using it as explained below. Simply swap the Kenwood filters with International's, then follow a brief alignment procedure to align the carrier frequency at the proper point on the newly installed filter's response curve.

Installing the switching board and the two SSB filters is a one-evening project. Progress is slow because of some ambiguity in the text of the instructions. International Radio assured me that new instructions are in preparation. I assume this will clear up the discrepancies.

Long coaxial cables connect filters to the switching board. There is just no room to

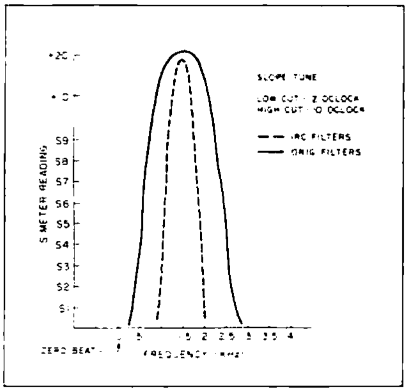


Figure 4. Slope tune. Low cut at 2 o'clock, high cut at 10 o'clock.

mount the filters and switching board as a single unit. As it is, the combination of long coaxial cables, an unshielded board, and long, insufficient ground runs allow some extraneous pickup. The result is a continuous beat note heard when operating CW. This is most noticeable when the International Radio filters are switched into the circuit and the CW Broad/Narrow is in the broad position. However, even when the switch is in the narrow position and the 400 Hz CW filters are selected, the annoying tone persists, although much attenuated. Adjusting the notch control to passband center just makes the tone louder.

This ever-present tone is not acceptable. I definitely recommend against using the switching board if you plan to operate CW with your TS-930S.

This problem didn't occur with the original SSB and CW filters in place. Other TS-930S owners I know who use the International Radio filters haven't experienced this problem. None of them are using the switching board. This confirms the advice I gave in the previous paragraph. If you want the added performance the International Radio units can provide, replace the original Kenwood filters.

Conclusions

Serious DXers will probably like the narrow receiver response. The curves in Figures 2 through Figure 4 show the range of IF curves available at various settings of the TS-930S' "Slope Tuning" controls. Switching between the original Kenwood filters and those from International Radio make the TS-930 seem like a different transceiver. I both like and dislike the effect. It would be nice to have both sets of filters available. Most of the time, I prefer the naturalness of Kenwood's filters, even if they are a little too broad. The "Slope Tuning" controls are provided to permit you to adjust the IF response to best suit your taste or operational conditions. However, when the going gets really rough or I get down to the serious business of listening to a weak SSB signal through a storm of big signals, it's nice to have the new narrower filters in there helping out.

So, the choice is yours. If your operating needs require every bit of receiver performance you can muster, then these filters are for you. They get the job done! If, on the other hand, you are happy with your transceiver the way it came from the factory and you hear everything you want to work anyway, you probably won't enjoy giving up the velvet smooth audio quality of the standard filters.

Jim Thompson W4THU can be reached at 3207 Dogwood Drive, Portsmouth VA 23703 title (804) 484-0140

73 Book Review

Number 18 on your Feedback card

The Low and Medium Frequency Radio Scrapbook, 5th Edition

reviewed by Larry Antonuk WB9RRT

Written and Published by Ken Cornell W2IMB
8½ by 11, 138 pages, $15.00

My experiences with the "Experimenter's Band" all took place several years ago, in a high school electronics class. The big project of the year was a 170 kHz transceiver. It used several tubes, coils wound on paper towel tubes, and a strange collection of government surplus parts. The only hitch concerned the fact that I was the only student who actually completed his project. At the end of the year the instructor brought in his set—we had a short QSO over a distance of about fifty feet, and it was summer vacation. My 1750m station was put on a shelf, forgotten, and was eventually lost in the shuffle.

It's been quite a while since 1976, so the whole concept of the 1750m band was just a dim memory. Over the past several months I've been talking to more and more lowfers and I'm pleased to report that the unlicensed low frequency bands are alive and well, and filled with hundreds of hard-core experimenters. Many of these lowfers are also hams, reliving the early, exciting days of their radio careers.

A Closer Look

One of my more pleasant low-band discoveries was the existence of the Low and Medium Frequency Radio Scrap Book. Truly the current "bible" of low-band operation, this book covers every possible aspect of unlicensed operation.

If you've fallen into the practice of judging books by their covers, you'll need to look a little more closely in this case. The book itself consists of 138 staple-bound pages chock full of information, making it well worth the money. The book is mainly a construction manual, but a fair amount of information is given on the various bands available to unlicensed operators.

You'll find circuits for several transmitters and receivers, both tube and solid state. Wire, loop, and active antennas are discussed. If you need a simpler approach, build a transverter for your 80m rig. The fifth edition covers coils and coil winding in detail—other editions focus on various subjects. In addition to the construction information, there are sections on solar flare observation and ionospheric disturbance reporting. Once you decide to take the plunge, refer to the list of parts/radio/kit suppliers at the end of the book.

Two youngsters (of any age) could have a ball with this book. Whether you want to do across-town QSOs, beacon operation, or propagation studies, the Radio Scrap Book has something for you. Now, where did I put those empty paper towel tubes?

Number 19 on your Feedback card

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B
3335 Fieldstone Dr.
Doylestown PA 18901

THE BEST AND THE WORST OF 1987

I know, I know. . . this was supposed to run in January. Things got a bit out of hand here with business travel and other projects. Better late than never!

The Best:

By far, Novice Enhancement. This might just be the turning point for the future of amateur radio. More hams mean more clout in Washington, and might mean fewer proposals to take away "unused" amateur frequencies for outside interests.

The Worst:

Easy. Docket 87-14, to delete the lower 2 MHz of 220 and reassign it to a service that doesn't need it so that service can employ a mode that is largely unproven to engage in communications that are unnecessary.

The Best:

An overwhelming assortment of equipment for Novices and 220 enthusiasts, largely due to Novice Enhancement and the efforts of ICOM who believed in the 220 market early on and made the commitment when others wouldn't.

The Worst:

Conditions during the January 1987 Sweepstakes.

A Close Second:

Conditions during the September VHF QSO Party.

The Best:

Conditions during the June 1987 VHF QSO Party. Operating 6 meters during this contest was like standing in the middle of a 20-alarm fire while the Pope holds a press conference, aliens are landing from outer space, and you are watching the Super Bowl, seventh game of the World Series, Stanley Cup and NBA finals for 36 hours. . . and trying to write it all down for posterity.

The Worst:

Mutek, Ltd. going belly up and out of the amateur business.

The Best:

The new IC-275/475A multimodes. They finally got the message.

The Worst:

Making reasonable airline connections from Newark (or anywhere) to Dayton '87.

The Best:

Yaesu's attempt to get hams interested in portable operation again with the FT-690R and FT-290R portables.

The Worst:

The increasing number of challenges to amateur antennas and towers by restrictive deeds, zoning and ordinances.

The Best:

Those amateurs who persevered and won their cases with intelligent planning, good legal counsel, and judicious use of PRB-1 where needed.

Close Second:

Those amateurs who helped them win, whether financially or otherwise.

The Worst:

Those hams who didn't bother or didn't care.

The Best:

An antenna manufacturer who had the guts to admit they had a problem with their baluns and attempted to correct the problem, after stonewalling it for too long, thereby winning back a lot of respect from many amateurs.

The Worst:

Miller Lite and doughnuts for breakfast during a contest. Some of us never learn. . .

The Best:

Those of you who made an effort to (1) try a new VHF/UHF contest this year (2) added a new band to your shack (3) built some new rig or accessory (4) finally fixed that 10-year- old 6-meter yagi with half the elements broken. . .

And Finally:

The Best wishes for 1988 to all readers. Hope it's your year!

Travelling Down the Road

Yours truly had to make a short business trip out to Los Angeles recently, and I took a few extra days to stay and chat with Wayne Overbeck N6NB and his wife Debbie. Many readers will recognize Wayne's call for the many articles and books he's published on a variety of amateur and computer topics. Others will remember him for the famous cross-country jaunts he took as K6YNB to put several states on the air for 2-meter EME. Still others will recognize the call as the one that dominated VHF contests in the single/multi class during the 70s.

Yep, Wayne's a busy guy. Shortly after I arrived, we hiked up to a hill west of Tustin to try a little 6-meter FM work with the FT-690R and a whip antenna. Contacts were quickly made on 50.300 simplex with members of the Southern California Six Meter Club (thanks for the monthly newsletters, folks!) over surprising distances. With a pipsqueak 3 watts, we worked well up north to the San Fernando Valley as well as around L.A. itself. There was so much smog that I couldn't see the city, but the radio reports assured me something indeed was there!

Wayne is currently Vice Director of the ARRL Southwestern Division, and is quite active in promoting the hobby and speaking before clubs in his division. He is a professor at Cal State Fullerton and the University of Southern California, where he lectures in communications law. In addition, Wayne and Debbie enjoy buying older homes and fixing them up, which keeps them very busy. Add to that Wayne's continuing interest in VHF/UHF DXing and contesting, there's not much time left over!

"More hams mean more clout in Washington."

Wayne is also somewhat famous for his tower-on-a-trailer designs, ready to head off to the nearest peak at the drop of a hat. Right now, a Tri-Ex LM-470 crankup atop a custom mobile trailer occupies a good part of his driveway.

It's quite possible that Southern California is the most difficult place to erect a tower with respect to deed restrictions and zoning. While we were out driving along I-5 to San Clemente, Wayne pointed out town after town and development after development where towers weren't allowed. Quite depressing! It seems you have to buy in an older community to even think about a tower.

I did mention contests, right? Wayne hasn't been too active lately, but in the 70s he copped national first place in the June contest from 1973 to 1977, consecutively, and the September contest from 1975 to 1977. In fact, Wayne has pulled off a #1 finish nationally 12 times over the years in VHF contests. This guy really takes his hamming seriously! I called Wayne a few days afterwards, and he'd just come down from Saddle Peak after working a tropo opening into Hawaii on 2-meter sideband.

Antenna Parties

You know, the kind where there's lots of beer and munchies

Photo A. Wayne Overbeck N6NB enjoys some mountaintop 6-meter operation with the Yaesu FT-690R.

Photo B. Dave Porter K2BPP atop the 40-ft level, getting ready to put up the last 10-ft tower section.

afterwards? Well, I went to one of these at Bill Radice K2OWR's place in Liberty Township, NJ, a few weeks ago. Bill lives up on a 900-foot ridge with terrific views in virtually every direction, and he's put up an impressive collection of towers and antennas. The day I arrived, he, Dave Porter K2BPP, Leroy Sliker KA2UHS, and Steve Katz WB2WIK were topping off 50 feet of Amerite tower with a 5-element HyGain "clone" for six meters. The weather was just right. . . sunny, cool and lots of wind! Well, it seemed like it when I climbed the 70-foot Rohn 25 tower to get a few photos of the site.

Bill is an old-time VHF operator, first licensed in the late 50s. He was quite active on 6, 2 and 220 AM in the 60s and contested as part of the old Interstate VHF Society (WB2GKE) along with Steve and many others. They staged many an operation from Sheep Hill in Boonton, NJ, and the callsign K2XR was more often than not atop the standings for the Hudson Division in January, June and September.

Bill's getting back on in a big way from his new "modular" QTH! On 2, he runs a pair of 4CX250Bs to 19 elements for a whopping signal, and two stacked FO-22 yagis with 100 watts do the trick on 432. A 4-bay array of F9FT 23-element yagis and a single 7289 get out quite well on 1296. It was only logical that he get back on 6 meters with an MMT 50/28 and outboard amplifier. Look for him this year in the various contests! (Now if he would just put up the 14-element yagi I left there and get on 220 MHz.)

News, News, and More News

The National Contest Journal (NCJ) added a regular feature on VHF/UHF contesting. It's cowritten by Curl Roseman K9AKS, Mike Owen W9IP and Emil Pocock W3EP, and contains some very useful observations. Whether you are a serious VHF contester or just getting your feet wet, I suggest you take out a subscription. It's available for $10/year (6 issues) from the ARRL, 225 Main Street, Newington CT 06111.

The Cuyahoga Falls Amateur Radio Club is sponsoring the Crazy 8's HF, VHF and UHF contest to be held from 1400Z February 6 to 2300Z February 7, 1988. Hams outside the 8th call area work only 8s, hams inside work everyone else. Multipliers on HF are State, Province or DX Country; on VHF/UHF they are grid squares. All bands from 1.8 to 1296 MHz are valid except 10 MHz. All modes are acceptable, including repeater and satellite contacts! The list of multipliers is too long to mention here, so if you want to give it a shot, write Anthony Luscre KA8NRC at 5441 Park Vista Ct, Stow OH 44224 for more information.

Harry Schools KA3B is continuing with his excellent compendium of 6 meter data, stories and anecdotes. I've received issues #2 and #3 recently and there is a wealth of information regarding the earliest 6-meter trans-Atlantic contacts as well as a trip down memory lane with old antennas and radios. If you have the slightest interest in this band, these are must-reads. Harry states that he cannot run a full-time subscription and printing operation, but will circulate as many copies as he can to prominent 6-meter operators around the world with the hopes that they will make it available to others. If you'd like to correspond with him, he can be reached at 1606 S Newkirk Street, Philadelphia, PA 19145.

A Towering Victory

Readers will recall the rotatable DX86 tower featured in September 1986 73 magazine ("A Rotatable What?"). Mike Crawford WA2VUN, whose handiwork is mentioned here from time to time is finally able to have one in his backyard after a year's blood, sweat, and tears.

Mike's neighbors took exception to this "monstrosity" marring his landscape, and dragged him into a series of hearings before the West Caldwell, NJ, Board of Adjustment. Mike retained Robert Cherry K2HBX as his attorney and wound up preparing exhaustive engineering studies of the sturdiness of his project. He also had to satisfy to the FAA that his tower presented no obstruction to aircraft and required no markers. All this was the result of his neighbor's attorney's actions to find a way to get it removed.

Mike did it the right way, and prepared for the final hearing by obtaining public information packets from the ARRL a month before and distributing them to all seven board members. The FAA inquiry was also resolved in his favor (no obstruction, no lights), and the overwhelming evidence presented in the engineering studies

> *"There was so much smog that I couldn't see the city, but the radio reports assured me something indeed was there!"*

proved (in essence) that the tower wasn't likely to fall over unless Armageddon was upon us! Bob asked me to testify if needed at the hearing on Mike's need to have such a tall tower for adequate communications on VHF/UHF bands.

Bob also circulated copies of PRB-1 to the town's attorney as well as his neighbor's attorney, so both were aware that some accommodation had to be reached. The night of the hearing, which didn't start until 10:30 PM and ended nearly at 1 AM, his neighbors made a proposal to drop their complaint if Mike would agree to plant 12-foot evergreens across the back of his property as a screen. All parties concerned agreed in principle to this, and then it was up to the Board to grant the necessary variance for the existing 110-foot structure. I got my chance to testify and, as luck would have it, the town retained as their own expert witness a local Extra-Class amateur (and engineer) who was a town councilman.

Mike won the case in every respect. He'll have to shell out a few bucks for the trees, but that's cheap insurance to keep his labor of love intact. Now he can crank it up without fear and get that 8877 fired up on 6 meters!

QRV on 903

Last but not least, I've finally added 903 MHz to the station here with the SSB Electronics LT-33S, about the only commercially-made piece of equipment for 903 on the amateur market. They're not cheap either, with the devaluation of the dollar boosting the price to a hair under $600. If you're disinclined to "roll your own," however, it's the only way to fly. I also ordered one of the Down East Microwave 33-element loop yagi kits for 903 and will have a review of it soon.

I plan on operating as many of the major contests as possible from mountaintops and rare grids on 903, 1296 and 2304 this summer, so I'll be looking for those readers who need such grids as FN22, 23 and 24, FN 34, and FN14 on these bands. More details on this type of operation will appear in this space soon. Until then, see you Above and Beyond! ■

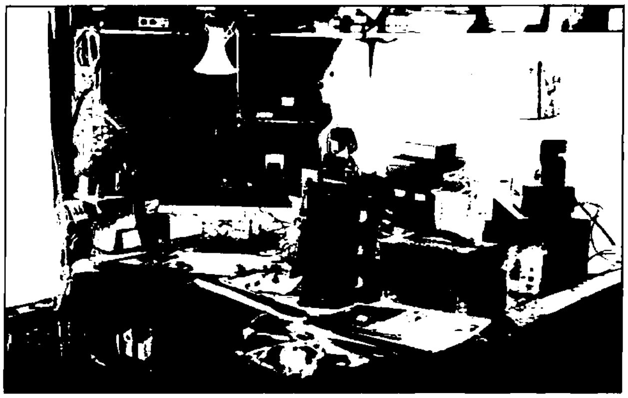


Photo C. K2OWR's shack in repair. He's very active on 144, 432, and 1296.

Helping and Hopping the HW-9

A few adjustments to make this QRP rig really perk.

by Terry F. Staudt, L.P.E. WØWUZ

In the summer of 1986, financial circumstances forced me to sell my FT-101ZD and MLA-1200. The ZD had Fox Tango filters plus other goodies, and I fully intended to keep it until the wheels fell off. In short, I was perfectly satisfied. The only consolation is I received an excellent sum when I needed it badly.

In May of last year my condition improved and with the "bug" biting my ankle off I was faced with the dilemma of buying someone else's problem that looked like it'd been kicked off a bridge, or starting from scratch. With a little remorse, I decided to go for a QRP rig and make the best of it.

I've had Heath products on and off since 1954 and was generally satisfied with them (although I could never keep my sticky fingers out of them). The HW-9 was on sale at the time, so I decided I probably couldn't go wrong and picked one up along the WARC band kit. I'm very glad I did—30 and 12 meters are fun bands.

The HW-9 was covered in the "QRP" column in July 1987 and reviewed by WB8VGE in August. While it was showered with flowers except for the vernier drive problem, nothing was said about some very obvious shortcomings.

I'm going to go through these and the inexpensive solutions, with a tip of the hat to Matt Adrian, senior technical consultant at Heath, who was very candid in response to a very detailed letter I sent.

First Things First

First of all, the vernier drive. This is a dreadful little thing that has all the torque of a mouse's tail. The only way to avoid having to replace the darn thing over and over (a crummy job), is to follow the installation instructions TO THE LETTER. Then, oil the brass reduction gear on the capacitor and give it a generous coating of office equipment or sewing machine grease. You really can't use too much. As stated in the manual and by

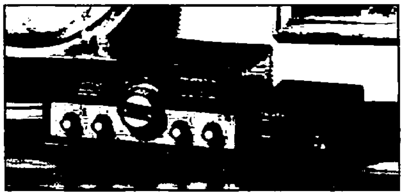


Photo A. The Heath HW-9 QRP transceiver.

WB8VGE, do *not* force the dial past its upper and lower stops. About the fourth time you do this, the vernier rolls over and dies. Heath is acutely aware of the problem and will replace it over and over until they obtain a better device.

VFO Improvements

The second issue is VFO drift and calibration. As stated by WB8VGE, this is a trial. The trimmer on the main capacitor and the slug in the coil move in lock step with each other, so you wind up chasing your tail. Having been involved with design engineering for some time, it bacame quite apparent that the mix in the VFO tuning slug had too much permeability. It's a bit much when you blow hard on a "diddle stick," and the frequency changes 2 kHz.

I'm lucky that I have plastic drawers full of

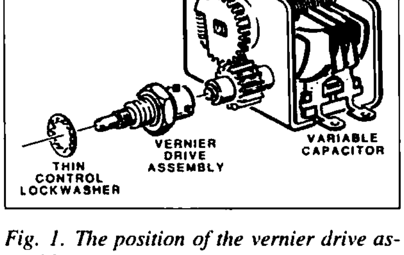


Fig. 1. The position of the vernier drive assembly.

cores pulled from junked TVs and other appliances. Even though their cores weren't coded, I felt a red or preferably a yellow mix was called for. (The yellow is the most stable, however it's generally used from 10 MHz to 40 MHz—the VFO is 5 MHz). Well, a ⅜" yellow slug did the trick and the frequency changes "smooth and greasy," as it should. It also cut the drift from about 3 kHz in 8 hours to 950 Hz. As for the linearity, there is *one* slotted plate on the VFO cap that a little judicious bending with a jeweler's needle-nose pliers will yield ± 2 kHz accuracy over the dial except for each end where it tends to lose its mind by about 5 kHz.

The VFO capacitor is grounded through the planetary gear and vernier drive, which causes a "swish-rustle" sound when tuning. Solder a piece of wicking to the capacitor frame through the "U" cut, through which the VFO coax passes. Then solder another piece of tinned shield where the first was soldered to the VFO coil shield can. This also drops the birdies substantially.

During assembly, I painted the inside of the VFO coil shield with flat black 'hobby' paint. The reason for doing this was simply the fact that it was so bright you could shave in it. One doesn't need any infra-red reflection in this area!

The IF and AGC

Although the receiver has no RF stage, the IF is hotter than a $2 pistol. In fact, it has to be de-tuned slightly (manual instructions) to keep from oscillating. Still, though, the almost total lack of background noise from 15 meters up bothered the heck out of me. Investigation turned up two problems. The first mixer, Q107, and MFE-131 dual-gate MOSFET had an injection drop-off rate of about .8 Volt per band as it went up. A quick look at the specs on this device showed it to be a bit of a wheel horse as these things go. Being very well acquainted with the 3N211 and having a few on hand, one was tried and voila! The

beginning of atmospheric noise. Not a lot, but it was definitely there switching between an antenna and dummy load. Now there was light at the end of the tunnel. (3N211s can be found at Fox Tango. I also am sure a 40673 would work about as well).

I found the AGC time constant to be much too fast. Evidently they didn't want to lose a 'dot' at 70 WPM. After watching the S-meter act like a geiger counter for a few days, I changed R312 from 47K to 150K and C317 from 3.3 to 6.8 µF. These are the resistor and capacitor that determine the AGC decay time and the values I used bring it up to 1.02 seconds. I now find it satisfactory, but it can easily be stretched out with a bit larger cap.

To liven up the S-meter, break the ground lead to R323 and add a 10K potentiometer in series. This allows the operator to adjust the meter's sensitivity for more realistic readings.

Also, reading relative power out on the meter is troublesome. Replace R431 with a 25K potentiometer and adjust it accordingly when transmitting into a dummy load.

Moving Right Along

The QSK circuitry of the HW-9 involves a whole lot of diode steering, but the almost essential feature (I hate relays) does introduce some losses. Here, Heath takes it on the chin by using the same old "carload" diodes everywhere. When Radio Shack sold Hewlett Packard 5082-2835 Schottkey diodes at two for $1.99 (276-1124), I bought a whole bunch. I replaced D301, 302, 403, 404 and 407—all in the RX RF path with them and an S-2 reference signal on 10 meters went to S-8. Now the receiver is a going proposition. (1N295s would be suitable if you don't have Schottkey's.)

Removing the T/R board looks like a project to be given a lot of thought and 807s. It's really easy once you know how. With the top and bottom covers removed, unsolder the blue wire from the key jack. With the unit on its top and rear facing you, remove the rear panel (6 Phillips screws). Remove the bandswitch shaft and put the retaining collar in a safe place. Then remove the ¼" nuts from the T/R board. Place a washcloth over the front panel for scratch protection. Now lift the T/R board from the rear, setting it vertically, and simultaneously gently lay the rear panel over the front.

Final Points

The transmitter, while really very good, had just a few problems. Again, very easy to solve. The first thing was the inadequate heat sinks on Q405 and 406 PAs. The finals are TO-5s and the sinks are tiny two finned "top hats." They run hot, and they'll eat up your fingerprints without a burp. I lost a pair of finals (I used thermal compound—Heath does *not* supply it) and not wanting it to happen again looked in vain for better sinks. They're in catalogs but nobody carries them. I finally found some U-shaped beryl TO-220 sinks with slotted fins at Gateway Electronics, a surplus house in Denver. Bandswitch shaft clearance is a factor here. After careful physical alignment, I super-glued them to the tops of the existing "hats". Now I can touch them all day—they just get warm.

The other problem was instability on 15 meters. While advancing the TX level control the meter would suddenly slam "hard right," and the frequency counter would go nuts. I remedied this by adding a little emitter bias (.7Ω, three 2.2 Ω resistors in parallel on each PA). Now, *here's* a problem Heath is aware of. Whew! TX transistor Q402 is being changed to Heath part #417-293 (2N5770) and Matt Adrian advises all HW-9 owners to send for one. It's free whether the unit is in warranty or not.

In summary, would I buy it again? I sure would. For a few bucks worth of refinement which can be done during assembly (which is no snap), and a *decent* antenna, this puppy will work anything you can hear. The selectivity is excellent, as is the RIT.

On the whole, you can't beat it for pure fun. Enjoy. ■

Terry Staudt W0WUZ has been a ham since 1954, and has contributed to the pages of 73 since 1961. He enjoys rag-chewing DX (almost mutually exclusive!). A licensed professional engineer, Terry consults for TV and radio stations nation-wide and is a senior technical editor for Monitoring Times. *He can be reached at 716 N. Roosevelt Ave., Loveland CO 80537.*

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1750 METER TRANSVERTER PARTS LIST

Resistors	(Ohms)	Resistors	(Ohms)	Resistors	(Ohms)
R1, R26	470	R9, R20	51	R29	4.7
R2, R11, R12	47	R10	560	R30	1.0 1Watt
R3	82k	R13–R18	300 2W	R32	2k PC Pot
R4	22k	R19	2.5K 1/2W	R33, R41	4.7k
R5, R31, R36	1k	R22	1.5k	R34	680
R6, R24	270	R23	33	R35	100
R7, R21, R27	2.7k	R25	180	R37, R38	2k
R8	6.8k	R28, R39	10	R40	10k PC Pot

All resistors are 1/4 watt, unless noted. K = 1000, all pots are linear type, printed circuit top adjust.

Capacitors

C1, C2, C4, C19	.01 50 Vdc Min. Polystyrene
C30, C31	.01 50 Vdc Min. Polystyrene Radial
C3, C20	.005 16 Vdc Min. Polystyrene
C5, C7, C12–C14, C33–C35	.1uF 50 Vdc Monolythic
C9	25pF Variable "highQ" type
C15	820pF Silver Mica
C16	.001 250 Vdc Min. Polystyrene
C17, C23	1uF 50 Vdc Electrolytic
C18, C21, C22, C24	4.7uF 35 Vdc Electrolytic
C25, C32	10uF 16 Vdc Electrolytic
C26–C29, C36, C37	2.2uF 50 Vdc Electrolytic

Transistors, Diodes, Misc

Q1, Q4	J310	Q6	2N2102	HS1	Q7	Heatsink
Q2, Q3	2N2857	Q7	TIP31A	HS2	Q6	Heatsink
Q5, Q8, Q9	2N2907					
Q10, Q11	2N2222	Q12	LM7812CT			
MX1	SBL-3	D1	1N4001			
K1, K2	DPDT PC Relay	D2, D3	1N914			
Y1	3.4995 MHz Crystal. .005% Tolerance .32 pF load. HC-18/U type case.					
F1A	1 Amp fuse "fast acting"	F1B	Fuse holder			

Transformers, Chokes, Coils

L1, L2	27.5uH Amidon T-44-3	39 turns, #28 Enameled wire
L3	4.7uH Choke	
L4	100uH Choke	
L5	3.3uH Inductor	
L6	180uH Amidon FT-50-61	54 Turns, #28 Enameled wire

T1	55 Turns Primary, 16 Turns Secondary. Primary uses #28 Enameled Wire, Secondary uses #30 AWG Wire Wrap type wire wound evenly over primary. Use Amidon FT-50-75 Toroid.
T2	55 Turns Primary, 6 Turns Secondary.Primary uses #28 Enameled Wire, Secondary uses #30 AWG Wire Wrap type wire wound evenly over primary.Use Amidon FT-50-77 Toroid.
T3	50 Turns of #28 Enameled Wire, twisted pair aprox. 4 or 5 twists per inch.Wind tightly and evenly over an Amidon T-68-3 Toroid.

PARTS ACQUISITION

K1, K2	Digikey Z304ND	MX1	Minicircuits SBL-3
L4	Digikey M7101	L5	Digikey M8019
Y1	Jan Crystals	R30	Digikey 1.0W-1
R32	Digikey SOG23	R40	Digikey SOG14
HS1	Digikey HS115	HS2	Digikey HS101
C17, C23	Digikey P6749	C18, C21,	
C25, C32	Digikey P6746	C22, C24	Digikey P6752
C26–C29, C36	Digikey P6750	L3	Digikey M8021
F1A	Digikey F115-ND	F1B	Digikey F002-ND
C1, C2,		C30, C31	Mouser 23PW310
C4, C19	Mouser 23PS310	C3, C20	Mouser 23PS250
C16	Mouser 23PS212	C15	Mouser ME232-1900-820
C9	Mouser 530-189-0509-5		

DIGI-KEY
P.O. BOX 677
Thief River Falls, MN
56701
(800)344-4539

AMIDON ASSOCIATES
12033 Otsego St.
North Hollywood, CA
91607
(818)760-4429

MINI CIRCUITS
P.O. Box 350166
Brooklyn, New York
11235-0003
(718)934-4500

JAN CRYSTALS
2400 Crystal Drive
P.O. Box 06017
Fort Myers, Florida
33906-6017
(800)237-3063

MOUSER ELECTRONICS
2401 Highway 287 North or 11433 Woodside Ave.
Mansfield, Texas — Santee, CA
76063 — 92071
(817)483-4422 — (619)449-2222

Continued from page 31

Experimenter Band Beacon List

FREQUENCY (kHz)	CALL	QTH	SKED
160.025	MAX	Wheatland WY	24 hrs/7 days CW, BPSK/ACII BR
160.600XK	NH	Monroeville NJ (FM29)	Occ. Secondary beacon, see MOO
163.93	AVV	Independence OR	Off air
193.930X	MSG	Paso Robles CA	Intermittent
164.44	D	Des Moines IA (EN31)	24 hrs/7 days
169.863XK	1SUN	Durant OK (OM23)	24 hrs/7 days
171.000XK	C8	Portsmouth NH (FN43)	24 hrs/7 days
172.38V	1LM	Plymouth MA (FN41)	24 hrs/7 days
174.38	SUK	Eldorado Hills CA	24 hrs/7 days
174.600X	8TXT	Sandusky OH (EN81)	BR
174.527	3KLR	Glenside PA (FN20)	24 hrs/7 days
174.65V	7FS	Montesano WA	On air soon
175.00X	HG	Toledo OH (EN81)	Nights
175.350XK	GEO	Wintergarden FL (EL98)	24 hrs/7 days
175.388XK	KRY	Chardon OH (EN91)	Off for summer
175.472	MUK	San Luis Obispo CA	TO
175.70	ARK	Leslie AR	Off for summer
175.703	FAW	Orem UT	24 hrs/7 days
175.85	R	Utica MI (EN82)	24 hrs/7 days
176.000X	HDO	Morro Bay CA (CM95)	24 hrs/7 days BPSK/ASCII
176.263	CO	Glenwood Springs CO (DM69)	24 hrs/7 days
176.30	BA	Lancaster IL (EM68)	On air soon
176.46	6ROJ	So. Whitley IN (EN71)	Weekends
176.925	HB	Hamden CT (FN31)	24 hrs/7 days
177.00	OA	Braintree MA (FN42)	Occ
177.00K	KJ	Chicago IL (EN61)	24 hrs/7 days
177.2	ABK	Akron NY	Weekends
177.26	NVA	Pahrump NV	Off for summer
177.506	UCP	Saratoga CA (CM97)	1400 to 1700 GMT daily
177.520	OW	Middlesboro MA (FN41)	Weekends
177.750S	CT	Flagstaff AZ (DM45)	24 hrs/7 days BPSK/ASCII
178.0 + 1V	N	Maiden NC (call change)	24 hrs/7 days, 19 N's/min
178.977	TIM	Pitman NJ	Occ.
179.000	MPM	Salt Lake City UT	24 hrs/7 days, BPSK/ASCII for 5 mins., CW 5 mins., alternately.
180.030	NTD	Oakland FL (EI98)	24 hrs/7 days
181.168	IZJ	San Gabriel CA	Daily, silent 0700-1100 GMT
182.00X	ZZZ	Loretto TN (EM65)	24 hrs/7 days
182.270XK	G	Palo Alto CA (CM97)	TO
182.62	FPV	Granada Hills CA	24 hrs/7 days
182.900XK	Z2	San Simeon CA	24 hrs/7 days
183.180XK	PRK	Saratoga CA (CM97)	24 hrs/7 days
183.86	PU	Toluca Lake CA	24 hrs/7 days
184.016	EK	Sunnyvale CA (Cm97)	24 hrs/7 days
184.320X	JR	West Hartford CT (FN31)	24 hrs/7 days, remote beacon
184.380	HO	near Hilo HI	Off air
184.500	JKS	San Anselmo CA	24 hrs/7 days BPSK/ASCII
184.599	O	Boulder CO	24 hrs/7 days
184.750XK	1SNN	Waltham MA (FN42)	1100–0100 WD/ 1100–2400 WKN 174.75
184.795XK	MEL	San Jose CA (CM97)	24 hrs/7 days
186.00	ZYK	Redway CA	24 hrs/7 days
185.410XK	XMGR	Cleveland TN (EM75)	24 hrs/7 days
185.49	AZ	Tucson AZ	24 hrs/7 days
185.50	UM	Rehoboth MA (FN41)	Occ
186.404XK	HRM	Oakland NJ (FN21)	24 hrs/7 days
186.900XK	DBQ	Ft. Washington PA (FN20)	TO
187.000XK	KP	Murraysville PA (FN00)	BR and occ. Weekends
187.000X	OMG	Treasure Island FL (EL98)	TO
187.006VK	OWR	Paso Robles CA	On air soon
187.04	TUG	Bel Air MD	Occ
187.263	Z2	San Simeon CA	Weekend Days
		This is the SKY station of Z2, horizontal polarization	
187.30	UPN	Cincinnati OH (EN79)	Off for summer
187.50	J	Los Angeles CA	24 hrs/7 days
187.50	KEN	Pt. Pleasant Beach NJ (FM29)	1000–1230 and 2200–2400 GMT
187.50	RM	Duluth MN	24 hrs/7 days
187.56X	JM	Broken Arrow OK	Off for summer
187.594XK	SM	San Jose CA (CM97)	24 hrs/7 days
187.700SK	SO	East Haven CT (FN31)	Occ.
187.846XK	XY	Kearny NJ (FN20)	24 hrs/7 days
187.900XK	MOO	Monroeville NJ (FM29)	Weekends
188.470X	9HDQ	Daleville IN (EN70)	24 hrs/7 days (back on air)
188.700SK	WI	Owings MD (FM18)	24 hrs/7 days
189.00	JUG	Cincinnati OH (EM79)	24 hrs/7 days
189.210XK	QYV	Donora PA (FN00)	24 hrs/7 days
189.380XK	TH	Colts Neck NJ (FN20)	24 hrs/7 days
189.56VK	1RB	Foxboro MA (FN42)	Off for summer
189.700XK			
189.729XK	GHK	Palm Bay FL (EL98)	24 hrs/7 days
189.729XK	8LXJ	Morrow OH (EM79)	Off for summer
189.90XK	NTS	Mercury NV	24 hrs/7 days
189.834X	ABC	Hilton Head Islands SC (EM92)	24 hrs/7 days

NOTES: Column 1—Frequency, Column 2—Identification, Column 3—Location, Column 4—Grid, Column 5—Operation schedule. X—Crystal control, S—Synthesized, V—VFO, frequency may vary. K—Progammable Keyer. BR—By request. Occ—Occasionally. TO—Temporarily off air.

Thanks to Brice Anderson's On the Air.

ATV

Ham Television

Mike Stone WBØQCD
PO Box H
Lowden IA 52255

Ham QRP TV

One of the most successful Amateur Fast Scan TV low-power, transmitters is PC Electronics Model KPA5 "Kreepy Peepie" module. It's been out on the market with just a few minor improvements for over two years now.

The module is a circuit board, and all the parts are assembled and aligned by the Arcadia California factory facility. The buyer needs only to put the module into a case, add a few switches and holes for connectors, and begin to have fun with low-power ATV! The KPA5 unit measures about .5–.6 watt out on a Bird 43 wattmeter (using a 10-watt 400 MHz slug) on an averaged video-content picture-modulated image. It passes good color and sound signals. The small 3.25" x 4" size fits anywhere, and needs only a 300 mA, 13.8 VDC supply. It can be crystalled-up for one or two transmitting frequencies. The most popular ATV frequencies are 439.25, 434, and 426.25 MHz.

Microphone input takes a low-Z dynamic type, and there's also a line audio input. The unit can be used as the foundation for a large base-station exciter (with a higher power amplifier) or for direct uses such as remote-controlled aircraft or other vehicles, portable parade, or special event remotes, remote transmitters, repeater transmitters, link transmitters, robotics, security monitoring, etc. A donated PC KPA5 unit flew 1000 feet on last summer's Ohio WB8ELK helium-filled balloon special event!

The KPA5 sells for just $159.

1-Watt ATV Transceiver

The TC-70, a complete one watt ATV transceiver system, is also available from PC. It is an attractive unit mounted in a Ten-Tec style box. The TC-70 has a sensitive UHF GaAsFET tunable downconverter (for receive) and standard 4.5 MHz FM audio subcarrier injection. You can hook up your 10-pin VCR camera directly with no need to adapt plugs or cut off connectors. The TC-70 runs about $300.

Don Miller W9NTP of Wyman Research in Waldron, Indiana, has similar offerings in his line of FSTV equipment. In the November 1987 issue of Spec-Com Journal (Volume 17 No. 9), Don announced a new Milliwatt Hamband ATV Transmitter ($60). These units are very low-power and good for certain home applications. Wyman also has a one watt transmitter and transceiver package. The WR-450 transceiver sells for $300. It has a few more features than PC, including on-carrier sound. Both competitor's units work very well.

I suggest you send SASEs to both companies. Tell them my column in 73 Magazine sent you.

New ATV Nets on 20 and 75 Meters!

Bill Brown WB8ELK and I kicked off an FSTVers Coordinating Net every Tuesday evening on 3.870. It's very well attended. We can actually be found somewhere between 3.860 to 3.870 MHz on the 75-meter band. Finding a clear frequency is often nearly impossible. There's an early net at 8 p.m. EST, controlled by WBØQCD. The late net's on at at 10 p.m. EST, controlled by WB8ELK, or WA4UMU in South Carolina. Besides some good check-ins covering the East Coast and most of the Midwest, some technical discussions get going among members of AVT groups and clubs about antennas, the video signal, DXing, etc.

"Who coordinates the coordinators?"

Why not join in on the fun? We need representatives from all ATV clubs and groups in the country to check in and report about their local activity. A similar net on 20 meters is evolving with Dr. John Fox WB2LLB/4 in Alabama. Tune into 14.235 MHz on Sunday afternoons at 2 p.m. EST. John is mixing FSTV discussions with SSTV pictures.

Marty WDØBCE from The Davenport, IA, BRATS ATV Club was having a lot of fun running around the Quad-Cities "portable ATV" using a Radio Shack (Citzen) LCD Quartz mini-TV set! Gobble up these TV7s folks as we have found out that they go all the way down into the 421 MHz region on UHF just below Channel 14! Very few TV sets do that all. Yes, TV shortwave and monitor buffs, that means you can "tune-in" to local FSTV action without the need for a downconverter device. You will need a good antenna system though and maybe even a preamp unless you are very close to source. Sending and watching low-power ATV signals is FUN!

Super VHS Is Here!

Ready to buy a new VCR or CAMCORDER? SUPER VHS is here! Shown on the Today Show, December 4th, 1987, SUPER VHS offers nearly twice the definition as standard VHS pictures. Over 400 lines are represented on the TV screen (standard commercial TV is 525 lines in America). I have seen a demonstration and SUPER VHS is going to be the standard for all others to shoot against for I would say the next 10 years. Judge your pocketbook accordingly. For most of 1988, SUPER VHS will be expensive. Some good buys will become available on the old standard VHS systems. Now is the time to jump in and get yourself either a low or high grade unit!

14.240 MHz on weekends is where you will start hearing more of those shrill tones called amateur facsimile. The recent announcement by AEA of a new PK-FAX software program for PK-232 and IBM (and clone) users for FAX picture video TV screen receive and transmit has opened up a lot of new possibilities. I was asked to play around with AEA's new software and give them my feelings about what they had developed. I am helping them now for some great future projects at AEA. Users of FAX are scarce—but they are around. Greg Mengel took over the editor's position of the Environmental Satellite Users Group publication and will soon be promoting FAX transmit capability on all bands. There has already been a fair amount of exchange done in the past couple of years using computers and dedicated FAX machines. Japan leads the world in FAX hobby use. They can be heard on 14.240 Mhz during early morning hours.

ATV Frequency Coordination

There is a growing problem today with some established state frequency coordinators tackling the complicated responsibilities of sensible spectrum management when it comes to FSTV on UHF. The USATVS has heard a number of reports of gross discriminations by state frequency coordinators against ATVers.

Part of this has been our own fault! We haven't organized and been there to help them make these decisions in our favor. Tom O'Hara W6ORG has been hollering about this for years as has been the old A-5 publication. We need your help! Register your system with your state coordinator at once! Many state frequency coordinators have improperly assigned FM links and repeaters to slots alloted to ATV according to the ARRL band plans.

ATVers didn't speak up and they got away with it for awhile. They worked simplex for many years at 439.25 MHz and then recently decided to build up an in-band 70cm ATV Repeater system. They got a rude awakening when they filed to coordinate the 421 and 426 MHz output channels. If you are having a problem like this, whatever the cause, write to the USATVS for help.

A "Frequency Coordinator's Guide to Placing ATV Signals with Guard Channels" package is available from the USATVS, which may help you with your ATV problems. Copies were mailed to all listed frequency coordinators recently. These situations must be addressed. I spoke several times with Dave Sumner K1ZZ at the League about the coordination problem, but the League doesn't feel it can address the issue since they do not themselves coordinate or sponsor coordinators.

Who coordinates the coordinators? The League or the FCC will eventually have to address this worsening issue.

Spring is just around the corner! Are you beginning to make plans for Dayton? We will be at The Ramada Inn North with our ATV Workshop once again on Friday and Saturday nights. The room will be crowded, so you better come early to get a good seat. See you on one of the ATV NETS on 20 or 75!

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

Nostalgia—
Philco To Hollywood

I sat glued to the dial. It had been years since I had tuned in to any of the world above the BC band. It was 1958, and there I was hearing voices from other countries. . .other nations. . .other places. Oh, I had heard them before many years ago when the old Philco console in our livingroom still had a semblence of life to it. The Philco had been a wedding gift to my Mom and Dad in the late '30s. It was state-of-the-art for its time: a dozen or so "loctal" tubes in the RF, IF, and audio preamp sections; a pair of 2A3s for audio output; and a Type 80 as the power rectifier.

That box really could blast you out of the room with 25 watts RMS into a 12" electrodynamic speaker. It also boasted the strangest record player ever designed—one that had the needle vibrating a mirror that modulated a beam of light going to a photocell. It only played 78 RPM records, but in that era that's all there was.

As a toddler I sat glued to the old Philco, listening to such programs as "Let's Pretend," "Big John and Sparkie," "The Lone Ranger," and of course "Little Orphan Annie." By age 5, I even had my very own Little Orphan Annie Secret Society Decoder Pin. To this day I can remember the vibrant tones of announcer Pierre Andre listing out the numbers that made up the "secret message" from Annie. For those born after WW II, I can only suggest that you rent a videocassette of "A Christmas Story" which was written and produced by my friend Jean Shepherd K2ORS. It tells it truly like it was.

Death of a Radio

Sometime in late 1950 or 1951, the Philco stopped playing. By the time it crackled its last, I was old enough to have discovered what the "other numbers" on its tuning dial were. By age 9, I had graduated from "Annie" to the "Beeb," and also to some other voices that spoke in tongues that I could not understand. In fact, I understood little of what was said on the BBC, but I listened intently because it sounded different.

About the time the Philco went to the place where good old radios go, my Dad went out and bought another toy. It was a strange object with a 10" glass window and was called an RCA Model 630 Television Set. Dad said it was a radio with pictures, and indeed it was. Soon, all of the characters I had learned to love in my imagination on the Philco were there in front of me on the RCA. Names like Big John Arthur, Andy Devine, The Lone Ranger, and Hoppalong Cassidy became living creatures in my kids' world, and the voices from the Philco soon faded into the ether. The Philco itself had become naught but a table to support the RCA "Looking Glass."

I had developed more than just an affinity for the technical side of radio and television. During my junior high years, I started hanging around a local radio store whose owner realized that I was not going to let him alone until he taught me everything he knew. His name was Sol Rosenthal, although we all called him Jommie. Thanks to Jommie, by the time I entered Lafayette High School in Brooklyn New York, I could completely field-strip and rebuild on-site any Victor, Bell & Howell, or Ampro sound projector that had been built to date.

I could troubleshoot any problem in a radio or television receiver and affect a cure. I had also gotten the Philco to play again, albeit poorly, and with quite a bit of hum. There was just no budget for a kid in his young teens to buy expensive electron tubes to replace those that had developed heater-to-cathode leakage. I lived with the hum, and that made shortwave reception impossible.

It was only a few days after starting high school that I met Henry Feinberg. To this day I can remember the odd lettering across his loose-leaf notebook. Just five characters: K2SSQ. I knew that was a ham radio callsign, so I surmised correctly that Henry was a radio amateur. In short order we had become friends; then close friends. It was on my second or third trip to Henry's house that he gave me an old Emerson table radio.

The Emerson looked like any other old radio except that it tuned two bands. It covered both the standard broadcast band plus shortwave from about 5 MHz on up to 18 MHz. It didn't work very well. But after a stop over at Jommie's shop and an hour session with the RCA Ryder Channelist and Clough-Brengle signal generator, we soon had the 1935 beastie percolating better than when it was new. Jommie was a true master at getting every microvolt of sensitivity out of a radio, and he walked me step-by-step through alignment procedures that were not in any book! By 7 PM that night, after Dad inspected the radio to make sure that I would not electrocute myself, I was busy tuning in the world. Little did I realize that moment was to shape my destiny and guide my life.

Graduation

Within a year, I graduated to a used Heathkit receiver. Another year and I obtained my ham license and built my first transmitter. Several years later I was among the first to introduce SSB to the VHF ham bands. With the advent of repeaters, I designed and installed the first split-split repeater to operate in a locality and in an era where most people felt that amateur radio and two-way FM had nothing in common.

Shortwave listening and ham radio led me to broadcasting as a career. I started in radio, did a stint in automated disco lighting, spent some time in consumer electronic service, and was playing with broadcast videotape recorders almost from the day that Ampex developed the VRX-1000. I've written and published several books and numerous magazine articles, and co-produced several films and videos. In "Amateur Radio's Newest Frontier," I got the chance of a lifetime and actually climbed aboard the spaceship Columbia. I again felt like a kid with a new toy—only a lot better!

Epilogue

Time passes. It's now almost Thanksgiving Day, 1987. Maybe that's why all this has been running through my head. After a while, one tires of repeaters, and repeater owners fighting the frequency coordinator, fighting a pirate repeater trying to take the channel, or fighting each other. I thought all that would have died by now, but with each wave of new hams, we get history repeating itself. Life goes on.

But, sadly, not forever. Jommie is gone. He was a good friend and a good teacher. Did I mention that he eventually became a ham and joined in on the fun with our old 6-meter gang? I was very sad to learn of his passing several years ago. I have a sneaky feeling, though, that he would be happy to know that the kid who hung around his store worked out.

Henry is still around. I've written about him before, and, in fact he has written a few articles for this magazine. While we were still in Lafayette High School, Henry got a part time job working with Don Herbert on Don's original "Watch Mr. Wizard" show. Talk about something that can change your life. Henry originally wanted to be an electronic engineer. Today he is the director of corporate exhibits for AT&T. He designed the Bell Telephone pavillion at Walt Disney World's Epcot Center in Florida, produced a number of award-winning films for the old Bell Telephone System, and just finished work on the brand new AT&T Corporate Exhibition Center in New York City. In amateur radio circles, I think he's probably best known as the ham who helped ET to call home. You may remember in the Spielberg classic "ET—The Extraterrestrial," the space communicator built from a party umbrella, Speak 'n Spell toy, and assorted electronic goodies. That "communicator" was designed and built by ham radio's own K2SSQ with parts purchased at the Dayton Hamvention Flea Market!

Have to run. Have to buzz-up Henry on the landline and get some information on how to fix the disk-drive for this Commodore C-64. One of them went belly-up a while ago, but even though he's 3,000 miles away, our friendship lasts the miles. What other hobby bridges the miles in less than a wink of an eye?

Oh yes, does anyone out there know what ever happened to some of my other high-school aged ham friends? Let's see: There was Vinnie Bonjourno WA2JYG; Bill Regina WA2PHR —and a special guy named Charlie Zusman WA2AKX. None of them are in the Callbook anymore. It's Charlie's fault that I became a ham in the first place. I must tell you that story sometime. The thoughts of yesterday race through my mind as I write the late shift from Los Angeles. ■

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Number 24 on your Feedback card

PROPAGATION

Jim Gray W1XU

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7A	14	14	14	14
ARGENTINA	21	14	14	7A	7	7	7A	14	14A	21A	21A	21
AUSTRALIA	21	14	7A	7B	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	14	14	7A	7	7	7	7A	14	14	14	21	21
ENGLAND	14	7A	7	7	7	7A	14	14	14	14A	14A	14A
HAWAII	21	14	14A	7	7	7	7	7	14	14	14	21
INDIA	14	14	7B	7B	7B	7B	7A	14	14	14	14	14
JAPAN	14	14	14B	7B	7B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7A	7	7	7	7	14	14	14	14A	14
PHILIPPINES	14	14	14B	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14	14	7A	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	14	14	14	14A	14A	14	14
U S S R	7A	7	7	7	7	7B	14	14	14A	14A	14	14
WEST COAST	14A	14A	14	7	7	7	7	14	14	14	14A	14A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	14A	14	7A	7	7	7A	14	14A	21A	21A	21
AUSTRALIA	21	14	7A	7B	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	21	14	7A	7	7	7	7A	14	14	14A	21A	21
ENGLAND	14	7A	7	7	7	7	7A	14	14	14	14A	14
HAWAII	21	14	14A	7	7	7	7	7	14	14	14	21
INDIA	14	14	7A	7B	7B	7B	7B	7A	14	14	14	14
JAPAN	14	14	14	7B	7B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	7B	14	14	14	14A	14	14
U.S.S.R.	7A	7	7	7	7	7B	14B	14	14A	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7A	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7	7	7	14	21	21A	21A	21
AUSTRALIA	21A	14A	14	14	7A	7A	7	7	7	7B	14	21
CANAL ZONE	21	14	7A	7	7	7	7A	14	14	14	21A	21
ENGLAND	14	7A	7	7	7	7	7B	7A	14	14	14	14
HAWAII	21A	14A	14	14	7A	7	7	7	14	14	21	21
INDIA	14	14	14	7A	7B	7B	7B	7A	14	14	14	14
JAPAN	14A	14A	14	14	14B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7A	7	7	7	7	14	14	14	14A	14A
PHILIPPINES	14A	14	14	14	14B	7B	7B	14B	14	14	14	14
PUERTO RICO	14A	14	7A	7	7	7	7	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	7B	7B	14	14	14A	14	14
U.S.S.R.	7B	7B	7	7	7	7	7B	14B	14	14	14	14
EAST COAST	14A	14A	14	7	7	7	7	14	14	14	14A	14A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.
First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
# = Chance of aurora.
NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST

Propagation Forecast—February 1988

Propagation conditions for February will generally be good. Seasonal increases in the MUF will bring increased DX activity on the higher bands—expect 10, 12, and 15 meters to be open until early evening hours on many days of the month. Twenty meters will be open until well after dark. There will be some days, however, when the earth's magnetic field will be unsettled to active, rising to storm levels on a few days. Look for poor propagation on the 6th–8th, 17th–19th, and 24th–26th of the month. The remaining days should be good to fair. Monitor WWV to spot the trends in the Ap and K indexes, and be alerted to changes. The *higher* the A and K indexes, the *worse* the conditions of the HF bands. Atmospheric noise will still be low, so expect excellent propagation on 40, 80 and 160 meters after local dark. February is the prelude to March and April when spring—for the first time in many years—will bring really HOT DX and MUFs often above 30 MHz and even to 50 MHz! ■

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
	1 F–G	2 G	3 G	4 G–F	5 F	6 F–P
7 P	8 P–F	9 F	10 F–G	11 G	12 G	13 G–F
14 G–F	15 G–F	16 F	17 F	18 F–P	19 P–F	20 F–G
21 G	22 G–F	23 F	24 P	25 P	26 P–F	27 F
28 F–G	29 G					

BARTER 'N' BUY

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SPECIAL EVENTS

Ham Doings Across the Country

Special Events listings will be provided by 73 Magazine free of charge on a space-available basis. Announcements must be received by us by the first of the month, two months prior to the month in which the event takes place (by March 1, for example, for a May or later event). Please mail to Editorial Offices, 73 Magazine, WGE Center, Peterborough NH 03458. ATTN: Special Events

PUNXSUTAWNEY PA
JAN 31

Special Event Station WA3LVU will commemorate Groundhog Day on January 31, 1988. Starting time is 1400Z and operation will be on 20 and 40 meter phone band. Certificate for SASE to *Doug Hunter WA3LVU, Rockland Ave., Punxsutawney PA 15767.*

VERNON WINTER CARNIVAL
FEB 5–14

NORAC's special event station will again commemorate western Canada's largest winter carnival, the Vernon Winter Carnival. This special event station will operate daily during the carnival which will be held on February 5th to the 14th, 1988. Our operating frequency will be 14.235, with possible operation on all other bands depending on conditions. Any station contacting our club station "VE7NOR" will qualify for a commemorative certificate. To receive the certificate qualifiers are asked to send their QSL info and 2 IRC's or $1 to *NORAC, Box 1706, Vernon BC, V1T 8C3 CANADA.*

ST. CATHARINES ONTARIO
FEB 6

The Niagara Peninsula Amateur Radio Club Inc., is holding the 10th Annual Big Event, celebrating the 40th anniversary of the club with a Hamfest and dinner dance on February 6th at the C.A.W. Hall, 125 Bunting Road, St. Catharines Ontario. Admission $3, Tables $12 commercial and $5 non-commercial. Talk-in 147.24/84. For further information please write *N.P.A.R. Inc., P.O. Box 692, St. Catharines Ontario, L2R 6Y3 CANADA; or phone 416/937-0590.*

DEARBORN MI
FEB 7

The Livonia Amateur Radio Club will hold its 18th annual LARC Swap 'n' Shop on Sunday February 7th, from 8:00 AM to 4:00 PM, at Dearborn Civic Center in Dearborn, Michigan. ARRL/VEC amateur radio examinations will be given by the Motor City Radio Club. Plenty of tables, door prizes, refreshments and free parking. Talk-in on 144.75/5.35 and .52. Reserved table space of 8-foot minimum available. For further information, send SASE (4x9) to *Neil Coffin WA8GWL, c/o The Livonia Amateur Radio Club, P.O. Box 2111, Livonia MI 48151.*

DECATUR IL
FEB 12–13

The Cenois Amateur Radio Club will operate K9HGX from 1400Z to 0200Z on February 12th and 13th in honor of Abraham Lincoln's birthday. Suggested frequencies: 3.875, 7.250, 14.250 and 21.325 kHz on phone-3.725 and 7.125 kHz on Novice bands. For certificate, send OSL and large SASE to *K9HGX, Box 4595, Decatur IL 62521.*

NEWBURGH NY
FEB 13

The Orange County ARC will operate WB2SON February 13, 1500Z-2200Z, from Washington's Headquarters, to commemorate George Washington's birthday. Suggested frequencies: 3.860, 7.230, 14.260. Also, local 2-meter repeaters and packet will be active for contacts. For certificate, send QSL and 9 x 12 inch SASE (39 cents) to *OCARC, c/o Barbara Christopher N2AWI, RFD 2 Box 447, Wallkill NY 12589.*

TRAVERSE CITY MI
FEB 13

The Cherryland Amateur Radio Club, announces its Fifteenth Annual Swap 'N Shop to be held on Saturday, 13 February at the Immaculate Conception Middle School gymnasium, 218 Vine Street, Traverse City, Michigan, from 8:00 AM through 1:30 PM. Admission is $3; tables $5. Talk-in on 146.85 repeater. For information, contact *Mick Glasser N8DBK, 4102 Peninsular Shores Dr., Grawn MI 49637; 616/276-9203.*

MANSFIELD OH
FEB 14

The Mansfield Mid-Winter Hamfest/Computer Show will be held Sunday February 14, at the Richland County Fairgrounds. There will be prizes, forums and a flea market in large, modern, heated buildings. Doors open to the public at 7:00 AM. Forums include DX, Packet, ARES, and more. Tickets $3 in advance and $4 at the door. Tables $5 in advance and $6 at the door. Half tables available. Talk-in, call W8WE on 146.34/94. Advanced ticket/table orders must be received and paid by Feb. 4. For additional information or advanced tickets/tables send SASE to *Dean Wrasse KB8MG, 1049 Beat Road, Mansfield OH 44905; 419/589-2415 after 4 PM EST.*

MARLBORO MA
FEB 14

The Algonquin ARC is sponsoring the Electronics Flea Market at 10:00 AM to 2:00 PM, on February 14. Sellers are to arrive at 8:00 AM at Marlboro Middle School Cafeteria, Union Street off Route 85. Talk-in on 146.01/61 and 146.52. Admission is $2. Tables are $8 in advance, $10 at the door. Wheelchair accessible. For more information contact *Dan KB1WW at 617/481-1587 or write A.A.R.C., Box 258, Marlboro MA 01752.*

MELVILLE NY
FEB 14

The Long Island Mobile Amateur Radio Club, Inc., is holding its LIMARC Hamlest on Sunday, February 14, in the Electricians Hall, 41 Pinelawn Road, Melville Long Island. Doors open at 9 to 3. Admission is $4 and $3 after 11:30 AM. Sellers 4' x 6' tables are $12 or bring your own at $1.50 a foot, 6 foot minimum, helpers pay admission. Registration in advance only, check payable to LIMARC. L.I.E. Route 495 to Exit 49 N, ¼ mile right turn onto Pinelawn Road. Talk-in on 146.85. For more information contact *Hank Wener WB2ALW, 53 Sherrard St. East Hills NY 11577; 516/484-4322. Or Mark Nadel NK2T at 516/ 976-2366.*

LOVELAND CO
FEB 14–15

The Loveland Repeater Association will sponsor a special events station in conjunction with the Loveland Valentines activities. Operation will be up 25 kHz from the lower edge of the General class phone bands and up 25 kHz from the lower edge of the Novice 10 meter band. 1300 UTC–0700 UTC February 14th and 15th. Send SASE for QSL to *KA0VFF, Michael H. Walker, 3816 Ash Ave., Loveland CO 80538.*

POLK COUNTY
FEB 20

The Salem and Oregon Coast Emergency Repeater Associations will sponsor the 1988 Ham Fair on Saturday, February 20th beginning at 9:00 AM at the Polk County Fairgrounds. Admission is $4 in advance or $5 at the door. Activities include ARRL/VEC testing, giant flea market, exhibits, and commercial dealers. Talk-in on 146.26/.86. For more information write: *Salem Repeater Assoc., P.O. Box 784, Salem OR 97308.*

HARLINGEN TX
FEB 20–21

The South Texas Amateur Repeater Society will be holding their STARfest on February 20 and 21 at 9 AM Saturday (set-up at 7 AM), runs through Sunday. It will be held at Casa de Amistad (Civic Center), Fair Park Blvd. (from north, exit US 77 at Fair Park Blvd. exit, east half mile; from west, exit expressway US 83 at Lewis Lane exit, east toward US 77-north, and east from jct. with US 77 half mile.) Talk-in: English language, 147.39; Spanish language, 146.70. Advance is $5 and at the gate is $6. Contact for flea market, reservations *Dr. David Woolweaver K5RAV, 2210 South Sunshine Strip, Harlingen TX 78550; 512/425-7744 or 425-3128.*

SARASOTA FL
FEB 20–21

S.A.R.A., Inc., will be holding its 9th Annual Hamfest and Computer Show on February 20 and 21 at the Robarts Sports Arena, 300 Ringling Boulevard. There will be Forums, exams, Saturday Night Banquet, a QCWA Luncheon and prizes. Tables are $16, advance tickets are $5 and banquet tickets are $15. RV hookups are $10 a night. For more information contact *Al Matlick at S.A.R.A Inc., Sarasota Hamfest, Inc., 1817 Buccaneer Terrace, Sarasota FL 33581.*

HERNANDO COUNTY FL
FEB 27

The Hernando County Amateur Radio Association is sponsoring its sixth Annual Hamfest on Saturday February 27th at the Hernando County Fairgrounds Auditorium. Doors open at 8 AM and exams start at 9:30 AM. Preregistration is preferred. Advance registration is $2, at the door is $3, and the swap tables are $8. Free overnight parking is permitted. For more information contact *Regis Kramer W41LE, 900-2032 US 41 North, Brooksville FL 34601; 904/796-6802*.

DALTON GA
FEB 27

Dalton Amateur Radio Club will be holding its annual Hamfest at the North GA. Fairgrounds on Saturday, February 27 at 9 AM til 3 PM. License exams will be offered at the Western Sizzler Family Steak House. W.C.A.R.S. will be the VEC and advance reservations are encouraged. Mail reservations for exams to club *P.O. Box N4OTC at 404/673-2291 or K4FLG at 404/278-0630*.

HAMEL MN
FEB 27

The Robbinsdale Amateur Radio Club is sponsoring the 7th annual Midwinter Madness Hobby Electronics Show on February 27, 1988 at 8 AM. There will be a large indoor flea market, retail exhibits and FCC testing. The show will be held at Medina Ballroom, on highway 55, 4 miles west of I-494, in Hamel MN. Admission is $3 in advance and $4 at the door. Tables are $8 and half tables are $4. Talk-in on 147.60/00 K0LTC Repeater, 146.52 Simplex. To register send a SASE and Fees to: Robbinsdale ARC, P.O. Box 22613, Robbinsdale MN 55422. For FCC Exam Registration: Send completed Form 610, photocopies of Current License and Code Credit and $4.55 (Payable to ARRL/VEC) to: Ron Schultz, 6308 Peacedale Ave., Edina MN 55424.

DAVENPORT IA
FEB 28

The Davenport Radio Amateur Club will host its annual Hamfest Sunday, February 28 from 8 AM to 3 PM at the Davenport Masonic Temple. The event will feature a large indoor flea market, walk-in VE testing, food and prizes. For flea market tables and advance tickets: *Davenport Radio Amateur Club, 2131 Myrtle, Davenport IA 52804*.

LAPORTE IN
FEB 28

The Laporte ARC's Winter Hamfest is Sunday, February 28 at the Laporte Civic Auditorium. Laporte is 50 miles southeast of Chicago. Talk-in on 146.01/.61 and 146.52 simplex. Forum will include the Midwest Microwave Society's Construction exhibit and seminar (bring your SHF projects). Donation is $3. Table charge is also $3 and may be reserved in advance by SASE. *LPARC, P.O. Box 30, Laporte IN 46350*.

CUYAHOGA FALLS OH
FEB 28

The Cuyahoga Falls Amateur Radio Club's 34th annual Hamfest will be held at the Akron North High School from 8 AM to 3PM on Sunday, February 28. Tickets are $3 in advance and $4 at the door. Tables are $5, half tables available. Sellers may bring their own tables. Tables will be $6 at the door, if we have any left. SASE for ticket orders and table reservations, please. Plenty of room for buyers and sellers-over 32,000 sq. ft. Easy access from Tallmadge Ave., off ramp of North Expressway (Rte. 8). Talk-in on 87/27. Route 8 connects to all major expressways and Ohio turnpike. Details from *Bill Sovinsky K8JSL, 2305 24th St., Cuyahoga Falls OH 44223; 216/923-3830*.

LAND OF LEGEND CONTEST
FEB 27-28

Land of Legend Contest, is sponsored by the Newark Amateur Radio Association, from 1600Z February 27 until 2359Z February 28. Phone only. Certificate for working ten N.A.R.A. members, five for DX, during contest period. DX is other than W, K, N, or A. Exchange signal report, name, and QTH. Suggested frequencies: 80M 3.860 ±, 40M 7.235 ±, 20M 14.250 ±, 15M 21.335 ± and 10M 28.450 ±. Business size SASE and logs to *Newark Amateur Radio Association Contest, P.O. Box 149, Newark OH 43055*. Deadline for submission is March 31, 1988. For further information contact *Rick Crane KA8RBQ, 174 North Gay Street Newark OH 43055. Or Don Kinney KA8MAQ, 2843 Mount Vernon Rd., Newark OH 43055*.

CIRCUITS

Number 26 on your Feedback card

Great Ideas From Our Readers

Many readers will recognize the revival of this regular feature, which has been absent from the pages of *73* for several years. We welcome brief contributions of circuits. If your idea is published, you will receive a free subscription or a renewal. Clearly indicate that your submission is for this column and not a manuscript for an article.—Ed.

C-64 POWER SUPPLY

Having problems with your Commodore power supply? If so, Figure 1 will help you. When my power supply failed I opened the unit (some are sealed), traced wiring, and drew the schematic. The 3052 regulator was defective and I replaced it with the readily-available 7805. NOTE: The pin out is different. There are two types of supplies—those that have failed and those that are going to; so save this drawing.

–George Taylor WA4GUW
Muscle Shoals AL

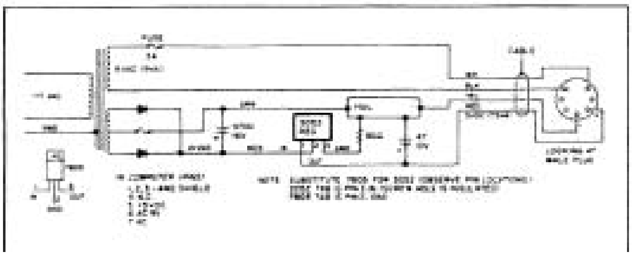


Figure 1. Power supply schematic for Commodore 64.

VARIABLE C-MOS OSCILLATOR

The oscillator section made up of the inverters (U1) is a typical oscillator configuration. The unique feature is the ability to alter the frequency of oscillation digitally. U2 is a CMOS transfer gate, which is used to parallel additional resistors (R2 and R3) with R1. The transfer gate U2 has four separate switch sections. Two switch sections are paralleled to provide a low-enough "on" resistance when a resistor is selected. The off resistance is high enough to prevent U2 or R2 and R3 from loading the oscillator when only R1 is selected. If a TTL interface is required, the unused sections of U1 may be paralleled to provide a single TTL load. The oscillation frequency can be approximated by F = ½.2RC. This formula will provide a "ball-park" value for the resistor and capacitor values. The value of C1 shown in the schematic is typical.

–Nick Hulbert KG5N
Colorado Springs CO

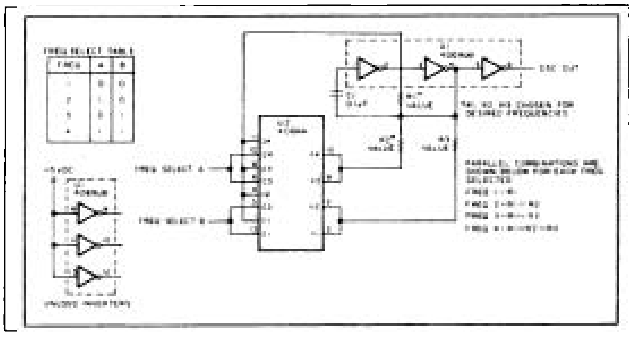


Figure 2. Variable CMOS oscillator. The U2 transfer gate switches additional resistors in and out, varying the circuit's frequency.

Number 27 on your Feedback card

WEATHERSATS

View On Video Processing

Dr. Ralph E. Taggart WB8DQT
602 S. Jefferson
Mason MI 48854

Purely Digital

Last month I spent quite a bit of time looking at a range of enhancement options using "transparent digital" techniques. This month I will finish up discussion of image processing with some information on purely digital techniques, usually implemented using a computer. All of these techniques are based on manipulating the numerical value of pixel data. This Is a fascinating subject I only can barely introduce in the space available this month. For those who want to pursue the subject in greater depth, most university and larger public libraries will have texts on digital processing techniques. One useful and inexpensive one ($14.95) is Digital Image Processing by Gregory A. Baxes, published by Prentice-Hall, Inc. of Englewood Cliffs, NJ 07632. Most bookstores will special-order a copy, or contact the publisher directly.

Computer-assisted digital processing can be used in a number of ways, depending upon the nature of the system. It can be incorporated into an outboard image processor of the type described last month. In this case the techniques apply to any display system since the processing occurs prior lo image display. The user can also incorporate the techniques into a computer-assisted scan converter by processing the image data between the A/D conversion and the storage of image data in memory. This is most suitable for systems where memory storage is limited. Finally, users can store linear data in the image memory and perform any processing when passing data from memory to the actual display part of the system.

The first two approaches are simple, but since any processing is performed "on the fly," any change in processing routines requires reloading the test image from tape. The third option requires a lot of RAM but allows multiple processing routines from a store of image data in RAM without having to reload the image with each trial.

Evaluating the Image

Although trial and error can work, it's best to have some information about the distribution of brightness values in the image. The most useful approach is to write a program to construct a graph or histogram of the distribution of various pixel brightness values in the picture.

As one example, a BASIC program could look at the contents of the video memory where the picture resides. If the memory contains 6-bit video values, then an array with 64 entries (0–63) is required, one for each possible pixel value. Stepping through the video memory is possible, PEEKing at the value of each pixel and updating the appropriate array entry by one. In the end the operator can step through the array and prepare a plot showing the number of pixels of each brightness value in the image. The major limitation with this approach is the time required to examinine a large video memory using BASIC. Analysis of only a few lines of video will save time. An assembly language subroutine can evaluate large blocks of memory very quickly and then revert back to BASIC to actually plot the data.

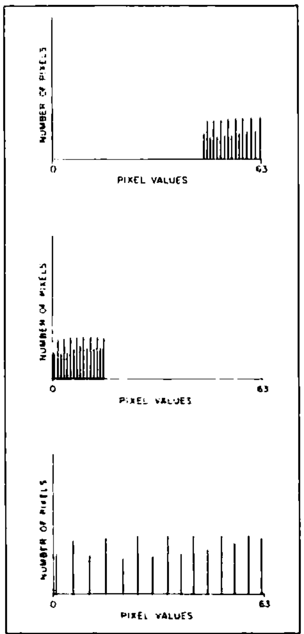


Fig. 1. Diagrammatic examples of pixel histograms showing data from:
(a) an IR line of NOAA APT data.
(b) the line after the "pixel slide". The purpose of a "slide" is to shift the entire cluster of pixels down the histogram so that the smallest pixel values will be zero.
(c) The line after multiplying each pixel value in 1B by 4. There is now a full range of contrast, with pixel values between 0 and 60.

Figure 1A shows a diagrammatic example of such a pixel histogram of hypothetical data obtained from an IR line of NOAA APT data. Note that all pixels are near the white end of the dynamic range. For the sake of argument, suppose they all fall in the range of 48 to 63. The aim is to expand the contrast of this data, which requires a two-step processing sequence.

The Pixel Slide

The process must first set the "blackest" pixel value, in this case a decidedly light 48, to true black or 0. This requires one of the most fundamental digital processing steps—the "pixel slide." A "slide" will shift the entire cluster of pixels down the histogram so the smallest pixel values will be zero. In the simplest case, with the data in Figure 1A simply subtract 48 from each pixel in memory and store the result back in place of the original value. The result is a distribution similar to Figure 1B. The picture remains low contrast, but the lowest pixel value is 0!

Practically speaking, pixel values less than the desired threshold will complicate real-world data. If this were real APT IR data, most of the pixels would be clustered as Figure 1A indicates. There would, however, always be pixels between 0 and 48 because of grayscale steps, minute markers, etc. Since the system probably doesn't like negative values for pixels, a real world slide would actually involve two possibilities for each pixel in memory:

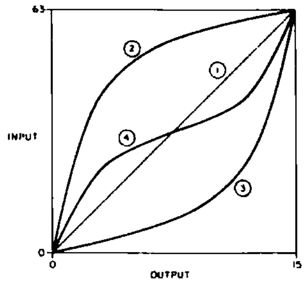


Fig. 2. A sample of four conversion curves that can be used to achieve a variety of effects. See text for details on what each curve means.

1. If the original pixel value is below 48, set the new value to 0; or

2. if the value is greater than 48, subtract 48 from the original value and store the remainder.

Most visible data in the video line with the IR and all the miscellaneous ones noted earlier will be converted to 0. The slide of the IR data is then complete.

Contrast Expansion

The video data in Figure 1B now consists of pixels in the range of 0 to 15. To generate a full range of contrast, multiply each pixel value in Figure 1B by 4. Figure 1C shows the resulting frequency distribution. This is a full range of contrast with pixel values between 0 and 60. A display of the new data will show a picture of excellent contrast.

Note, however, there only 16 discrete pixel values ranging from 0 to 60 in steps of 4. This underscores the need to always digitize the original data to significantly more resolution than actually needed for display. The original image contained 16 usable steps in the 48–63 range. There's no way to generate additional steps, even by expanding the contrast! If the original data had been 4-bit, the best expansion would have good contrast, but only 4 grayscale steps!

Visible Data

Although the above procedure would work for expanding IR contrast, what are the techniques for visible data? The steps may differ slightly, but the principle is the same. Consider a visible light distribution with pixels in the range of 0–15 with only IR data or miscellaneous minute marker/grayscale data in the 16–63 range. In this case a slide is not required, since the darkest pixels in the visible light data are already 0. First convert any pixels between 16 and 63 to 15, then carry out the expansion step.

How to expand some specific mid-range value? Simply clip all pixels below the lowest desired threshold to that value. Similarly, convert all pixels above the highest threshold to the high threshold value. Then perform a slide to set the low threshold to 0, followed by an expansion.

All of the previous discussion assumes the user changes the values in the main memory, but this isn't the only approach. If a lot of memory is available, the altered video data can pass to a buffer

memory or the display memory if that is separate from the main video buffer.

The operator can also perform the same conversions on the fly if desired. He'll need to run the tape through the evaluation program to get the initial pixel distribution, but once he knows what needs to be done, each pixel can be modified individually on a second run. In fact, although the previous discussion treated the slide and expansion as distinct steps, the user can perform both on each pixel with a single series of operations. In the case of the first IR example, the sequence might look like this:

1. Check the pixel. If less than 48, set it to 0 or,

2. if greater than 48, subtract 48 to perform the slide.

3. Multiply each pixel by 4 for the expansion

Nonlinear Processing

Everything discussed this month and last has involved clipping and expansion of video data. Clipping means throwing out data that falls outside of the range of interest and working with the rest. I did this last month by setting the A/D thresholds, while this month I did the same thing with our mathematical manipulations.

Many real world processing problems are more complex. For example, how to improve contrast of, say, the IR segment of a line without completely losing the visible light data? Alternatively, how does the user expand the contrast at the black end of the visible range in a visible light image, to improve the definition of land/water features, for example, without the complete loss of bright cloud detail? This is very difficult to do with analog circuits and is quite complex with last month's "transparent digital" approach. It is quite easy however with purely digital techniques.

Figure 2 shows a sample of four conversion curves used to achieve a variety of effects. Although the example illustrates the conversion of 6-bit data to 4-bit format, the process works between any combination of input and output format. Curve 1 is included for reference only since it represents a linear conversion in that the brightness characteristics of the output track those at the input. The remaining curves are quite different, however. Curve 2 represents a logarithmic expansion of the white part of the grayscale. The black data is not lost, it just occupies a smaller number of output steps than the original. The majority of the output steps are devoted to the white end of the dynamic range. Curve 3 is complimentary in that it performs a log black expansion. In this case, most of the output steps are devoted to the black end of the dynamic range with compression of the white data. Finally, Curve 4 is a mid-range expansion with compression of the extreme black and white ends of the dynamic range.

VALUE	COLOR
15	white
14	light cyan
13	light magenta
12	light blue
11	yellow
10	light green
9	light red
8	light gray
7	dark gray
6	dark cyan
5	dark magenta
4	dark blue
3	orange
2	dark green
1	dark red
0	black

Table 1. Grayscale-to-color conversions for a 4-bit display system that assigns bit 0 to red, bit 1 to green, bit 2 to blue, and bit 3 to intensity.

Expansions of this type are best achieved using lookup tables, since the math can get fairly complex. With 6-bit input data, the table would have 64 entries (0–63) with each entry representing the desired output value. Each processing curve would need a table, and the prepared graph would determine the output value required for each input value. The lookup table could be an array in BASIC (slow!), or the table would be in memory, in the case of an assembly language routine. In the latter instance, address the start of the table, offset by the input pixel value, and then read the value from memory. Assembly language lookup tables are more than fast enough for on-the-fly processing, and they are also a convenient way to pass data from the video memory to a display.

Although all of the discussion to this point emphasizes contrast expansion, there are lots of additional possibilities. Any number of oddball curves can be constructed to meet specific needs to highlight, emphasize, or recognize certain features in an image. There are also unlimited options for false-color displays, if the display allows that option. Depending on the number of colors available, a lookup table is a simple way to convert any brightness value to any color value. This gives absolute control over how the picture is displayed. This can be quite convenient, because it avoids the limitations on color values and sequencing inherent to dependence on a fixed assignment of data lines. For example, if a 4-bit display system assigns bit 0 to red, bit 1 to green, bit 2 to blue, and bit 3 to intensity, the various grayscale values will always translate to the colors listed in Table 1.

An image with a normal grayscale displayed in color would produce an absolutely chaotic range of colors very difficult to interpret and extremely difficult to view in the long run. A color lookup table would allow conversion of these values to any other value to achieve the desired correspondence between that grayscale step and the displayed color. IR data, for example, could be "rearranged" to provide a color spectrum that would be more easily interpreted in color terms (blues at the cold end, and reds, oranges, yellows, and white at the hot end). The user could also use a simpler color set, approximate water features in blue, land features in greens and browns, etc. This is not possible with any fixed arrangement of data lines, but it is easy to do with a lookup table, regardless of how the data lines are arranged!

The user's needs will determine the features incorporated into the processing system. For one thing, additional video routines and table do take up more memory, but usually the real memory usage occurs in the form of additional screen memories for all the new menus. Additional video options will also take up time, and that may be critical in on-the-fly applications.

If the basic A/D conversion takes up most of the available time, there will be a limitation in the number of modes the system can accommodate. If timing is a problem, try writing customized on-the-fly programs, each one incorporating one specific kind of processing option. Things are usually much simpler in the case of operating out of a large video memory and simply passing the data to the display in various ways. All data are treated in a linear fashion when the A/D data are passed to memory, and the processing function simply consists of different options in passing the data from memory to the display.

Well, that is an introduction to the world of image processing. No matter what kind of display system used, there are many ways to enhance the quality or utility of the images. Future columns may look again at specific projects, particularly for outboard processors, if there is an interest in the subject.

"An image with a normal grayscale displayed in color would produce an absolutely chaotic range of colors."

Number 28 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
2310 Romayor Court
Pearland TX 77581

AMSAT GENERAL MEETING

Space Symposium 1987

Beautiful, warm, sun-shiny Detroit, Michigan, was the site for the AMSAT NA General Meeting, Awards Banquet and Fifth Annual Space Symposium. Actually, I can't tell you much about the weather, since it was much easier to stay inside for the many fine presentations and thought-provoking discussions. Attendance was up from last year for this November gathering. Satellite enthusiasts from around the world converged on the Southfield Hilton, just north of Windsor, Canada. The Southeastern Michigan AMSAT members with Larry K8MU, convention chairman, put together an excellent weekend of activities.

This was the first year for a second, parallel, session of talks aimed at the non-ham with interests in space studies. For most hamsat chasers, the choices were easy. They went to the amateur radio sessions. For those with varied interests, the choices were sometimes impossible.

I had no difficulty deciding between an introduction to amateur radio, and Ray W2RS with his talk on low-power EME (Earth-Moon-Earth) operation. A few other choices were also easy, but when the competing talks included "Fast Scan Television Proposal for the Space Shuttle" by Andy N9AB and "Ham Radio from the Space Shuttle and the Space Station" by Dr. Tony England WCEN/0ORE, I found myself darting back and forth between the two rooms trying to catch the high points of both.

AMSAT President Vern Riportella WA2LQQ gave a fascinating presentation on techniques for determining satellite visual observation windows. In the other forum, previous AMSAT President Dr. Tom Clark W3IWI talked on digital versus analog signal-processing techniques. More decisions.

The choices went on all day Saturday, and even Sunday morning, when three presentations were in competition with the AMSAT NA Board of Directors Meeting. Even with so many tough selections, the symposium was a great success.

Some talks described activities via our current satellites. Craig Underwood, from the University of Surrey in England, recounted classroom applications of satellites in the UK. Most of his presentation covered telemetry reception and decoding activities using UoSAT-OSCAR-9 and UoSAT-OSCAR-11. Mori JK1VXJ presented a paper on the FUJI-OSCAR-12 mailbox system. His co-authors included JR1ING and JR1FIG.

On the technical side, topics like "Digital Signal Processing Modems" and "Spread Spectrum Ranging and Non-Linear Filtering for Orbit Determination" prevailed. While the subjects may seem difficult, this was not the case thanks to the speaking skills of Dr. Bob McGwier N4HY.

A Look Ahead

Looking to the future, two goals for AMSAT NA came through loud and clear. After the launch of Phase 3C this spring, AMSAT will make a strong commitment to launch a packet radio satellite in the next few years. Launch opportunities to LEO (Low Earth Orbit) may soon become available. A packet satellite can cut down the drawbacks usually associated with an orbit between 300 and 1000 miles, like short view times and a limited horizon. With a polar orbit and a mailbox system for message storage, the inconvenience of non-real-time communications is overshadowed by system simplicity and less expensive ground station requirements compared with a high-orbit or geostationary satellite set-up.

For the 1990s, we can look forward to Phase 4. AMSAT Vice-President for Engineering, Jan King W3GEY, and designer Dick Jansson WD4FAB gave the Phase 4 status report. They were also co-authors of another presentation on the attitude control system for this new family of long-life, geostationary hamsats. The technical challenges of the Phase 4 program are formidable compared to previous amateur spacecraft, and the expense will be more than 15 times greater than Phase 3C. After listening to the reports, discussions and arguments, Phase 4 still looks like the best program to pursue. Aim high.

There were many other fine talks and presentations. Two stand out due to their potential application to future amateur satellite programs. The first was entitled "NUSAT: A Student Satellite Project of Weber State College" by William Clapp, and the second was "70,000 Feet over Ohio, An Amateur Radio Balloon Experiment" by Bill Brown WB8ELK.

The NUSAT program (Northern Utah Satellite) began in 1982. The purpose was to build a satellite to test the possibility of evaluating Federal Aviation Administration air traffic control beacon antennas using low-earth-orbit satellites. NUSAT-1 was launched in the Spring of 1985. Although it lasted only a little over a year-and-a-half, its mission was significant to the amateur radio satellite community. It was the first satellite to be launched from a Space Shuttle Get-Away-Special canister (GASCAN).

Future hamsats may depend on the simple launcher mechanism designed by Weber State College students for NUSAT-1 and may even be constructed using a frame similar to that proposed for the larger NUSAT-2.

Bill Brown's talk and video presentation of his FSATV (Fast-Scan Amateur Television) experiments via weather balloon were excellent. Many ham radio groups around the world have used balloons to test transmitters, transponders and other experiments, but it is doubtful if any have generated and transmitted ATV this way. The equipment was simple, light- weight, used an omni-directional antenna (bent on take off), and Polaroid flat-pack lithium batteries for power. Bill's results may have significant impact on uses of ATV from the Space Shuttle and perhaps amateur satellites.

Photos A, B. Two of the notables at the AMSAT Symposium—Tony England W0ORE (white jacket and tie), who operated amateur radio from the space shuttle; and AMSAT President Vern Riportella WA2LQQ.

```
10   REM  ****************************************
20   REM  * PROGRAM NAME IS RS1011.BAS BY WA5ZIB *
30   REM  * VERSION 2.0          DECEMBER 8, 1987 *
40   REM  * CONVERSION FACTORS DERIVED FROM JANU *
50   REM  * ARY 1988 HAMSATS COLUMN, 73 MAGAZINE *
60   REM  * LINES WITH PRECEDING "REM" STATEMENTS *
70   REM  *  LABELED "VAX" SHOULD BE CHECKED FOR  *
80   REM  *  INCOMPATIBILITY WITH OTHER VERSIONS  *
90   REM  *  OF BASIC EVEN THOUGH THE PROGRAM IS  *
100  REM  *  SIMPLIFIED FOR EASE OF TRANSLATION   *
110  REM  ****************************************
130  PRINT
140  PRINT"*************************************"
150  PRINT"* RS 10/11 TELEMETRY DECODE PROGRAM *"
160  PRINT"*    BY ANDY MACALLISTER  WA5ZIB    *"
170  PRINT"*   VERSION 2.0  DECEMBER 8, 1987   *"
180  PRINT"*************************************"
190  PRINT
300  PRINT"RS 10/11 TELEMETRY FRAMES ARE COMPOSED"
310  PRINT"OF 16 FOUR CHARACTER BLOCKS WITH THE"
320  PRINT"SATELLITE IDENTIFIER, EITHER RS10 OR"
330  PRINT"RS11, PRECEDING AND FOLLOWING EACH"
340  PRINT"FRAME.   AFTER ANSWERING THE QUESTIONS"
350  PRINT"IDENTIFYING THE FRAME UNDER STUDY,"
360  PRINT"YOU WILL BE ASKED FOR THE TELEMETRY,"
370  PRINT"EIGHT BLOCKS AT A TIME  AS AN EXAMPLE."
380  PRINT"RS11,[illegible]"
390  PRINT
500  INPUT"WHICH SATELLITE (10/11)";SS
510  INPUT"DOWNLINK BAND (10/2)   ";DB
520  INPUT"ORBIT DATE (MM,DD,YY)  ";MO$,DA$,YR$
530  INPUT"ORBIT NUMBER           ";N
540  INPUT"FRAME IDENTIFIER FOR THIS ORBIT (A,B,C, ETC.)";F$
550  INPUT"TIME OF CAPTURE IN UTC (XXXX)";TI$
560  PRINT"NOW ENTER FIRST EIGHT BLOCKS OF TELEMETRY"
570  INPUT B1$,B2$,B3$,B4$,B5$,B6$,B7$,B8$
580  PRINT"NOW ENTER LAST EIGHT BLOCKS OF TELEMETRY"
590  INPUT C1$,C2$,C3$,C4$,C5$,C6$,C7$,C8$
600  PRINT
700  PRINT"TELEMETRY DECODED FOR RS";SS;" ON ";MO$;"/";DA$;"/";YR$
710  PRINT"ORBIT NUMBER ";N;F$
720  PRINT"TIME OF CAPTURE IS ";TI$;" UTC"
730  PRINT"DOWNLINK BAND IS ";DB;" METERS"
740  PRINT
1000      REM DATA CONVERSION ROUTINES
1100      REM BLOCK 1
1110      REM  VAX   LEFT$ COMMAND BELOW EXTRACTS LEFT 2 CHARACTERS OF B1$
1120 B1L$=LEFT$(B1$,2)
1130 IF B1L$="IS" OR B1L$="SS" OR B1L$="DS" THEN B1M$="80" ELSE B1M$="30"
1140      REM  VAX   RIGHT$ COMMAND BELOW EXTRACTS RIGHT 2 CHARACTERS OF B1$
1150 B1=VAL(RIGHT$(B1$,2))
1160 B1M=B1/4
1200      REM BLOCK 2
1210 B2L$=LEFT$(B2$,2)
1220 IF B2L$="IR" OR B2L$="SR" OR B2L$="DR" THEN B2M$="IN" ELSE B2M$="OUT"
1230 B2=VAL(RIGHT$(B2$,2))
1240 B2M=B2/10
1300      REM BLOCK 3
1310 B3L$=LEFT$(B3$,2)
1320 IF B3L$="ID" OR B3L$="SD" OR B3L$="DD" THEN B3M$="IN" ELSE B3M$="OUT"
1330 B3=VAL(RIGHT$(B3$,2))
1340 B3M=B3/10
1400      REM BLOCK 4
1410 B4L$=LEFT$(B4$,2)
1420 IF B4L$="IC" OR B4L$="SC" OR B4L$="DC" THEN B4M$="OFF" ELSE B4M$="ON"
1430 B4=VAL(RIGHT$(B4$,2))
1440 B4M=B4/5
1500      REM BLOCK 5
1510 B5L$=LEFT$(B5$,2)
1520 IF B5L$="IU" OR B5L$="SU" OR B5L$="DU" THEN B5M$="OFF" ELSE B5M$="ON"
1530 B5=VAL(RIGHT$(B5$,2))
1540 B5M=B5/5
1600      REM BLOCK 6
1610 B6L$=LEFT$(B6$,2)
1620 IF B6L$="IW" OR B6L$="SW" OR B6L$="DW" THEN B6M$="OFF" ELSE B6M$="ON"
1630 B6=VAL(RIGHT$(B6$,2))
1640 B6M=B6/5
1700      REM BLOCK 7
1710 B7L$=LEFT$(B7$,2)
1720 IF B7L$="IK" OR B7L$="SK" OR B7L$="DK" THEN B7M$="1" ELSE B7M$="0.3"
1730 IF VAL(RIGHT$(B7$,2))=0 THEN B7M$="OFF" ELSE B7M$="ON"
1800      REM BLOCK 8
1810 B8L$=LEFT$(B8$,2)
1820 IF B8L$="IG" OR B8L$="SG" OR B8L$="DG" THEN B8M$="1" ELSE B8M$="0.3"
1830 IF VAL(RIGHT$(B8$,2))=0 THEN B8M$="OFF" ELSE B8M$="ON"
1900      REM BLOCK 9
1910 C1L$=LEFT$(C1$,2)
1920 IF C1L$="AE" OR C1L$="UE" OR C1L$="OE" THEN C1M$="OFF" ELSE C1M$="ON"
1930 C1=VAL(RIGHT$(C1$,2))
1940 C1M=C1-10
2000      REM BLOCK 10
2010 C2L$=LEFT$(C2$,2)
2020 IF C2L$="AE" OR C2L$="UE" OR C2L$="AE" THEN C2M$="OFF" ELSE C2M$="ON"
2030 C2=VAL(RIGHT$(C2$,2))
2040 C2M=C2-10
2100      REM BLOCK 11
2110 C3L$=LEFT$(C3$,2)
2120 IF C3L$="AD" OR C3L$="UD" OR C3L$="OD" THEN C3M$="OPEN" ELSE C3M$="CLOSED"
2130 C3=VAL(RIGHT$(C3$,2))
2140 C3M=C3-10
2200      REM BLOCK 12
2210 C4L$=LEFT$(C4$,2)
2220 IF C4L$="AC" OR C4L$="UC" OR C4L$="OC" THEN C4M$="OPEN" ELSE C4M$="CLOSED"
2230 C4=VAL(RIGHT$(C4$,2))
2240 C4M=C4-10
2300      REM BLOCK 13
2310 C5L$=LEFT$(C5$,2)
2320 IF C5L$="AK" OR C5L$="UK" OR C5L$="OK" THEN C5M$="10" ELSE C5M$="2"
2330 C5=VAL(RIGHT$(C5$,2))
2340 C5M=C5/5
2400      REM BLOCK 14
2410 C6L$=LEFT$(C6$,2)
2420 IF C6L$="AV" OR C6L$="UV" OR C6L$="OV" THEN C6M$="IN" ELSE C6M$="OUT"
2430 C6=VAL(RIGHT$(C6$,2))
2440 C6M=C6/5
2500      REM BLOCK 15
2510 C7L$=LEFT$(C7$,2)
2520 IF C7L$="AX" OR C7L$="UX" OR C7L$="OX" THEN C7M$="IN" ELSE C7M$="OUT"
2530 C7=VAL(RIGHT$(C7$,2))
2540 C7M=C7/5
2600      REM BLOCK 16
2610 C8L$=LEFT$(C8$,2)
2620 IF C8L$="AE" OR C8L$="UE" OR C8L$="OE" THEN C8M$="1" ELSE C8M$="0.3"
2630 C8=VAL(RIGHT$(C8$,2))
2640 IF C8=0 THEN C8M$="LESS THAN 32"
2650 IF C8=>70 THEN C8M$="about "+STR$(INT(32+(C8-80)*6.052632))
3000      REM PRINT ROUTINES
3010 PRINT
3100 PRINT"RS";SS;" ";B1$;" ";B2$;" ";B3$;" ";B4$
3110 PRINT"     ";B5$;" ";B6$;" ";B7$;" ";B8$
3120 PRINT"     ";C1$;" ";C2$;" ";C3$;" ";C4$
3130 PRINT"     ";C5$;" ";C6$;" ";C7$;" ";C8$;" ";"RS";SS
3140 PRINT
3200 PRINT"Data sampling period is once every ";B1M$;" minutes."
3210 PRINT"20 dB transponder receiver attenuator is ";B2M$;"."
3220 PRINT"10 dB transponder receiver attenuator is ";B3M$;"."
3230 PRINT"15 Meter receiver is ";B4M$;"."
3240 PRINT"2 Meter receiver is ";B5M$;"."
3250 PRINT"Special service channel is ";B6M$;"."
3260 PRINT"10 Meter beacon transmitter power is ";B7M$;" Watt(s)."
3270 PRINT"2 Meter beacon transmitter power is ";B8M$;" Watt(s)."
3280 PRINT"First memory board is ";C1M$;"."
3290 PRINT"Second memory board is ";C2M$;"."
3300 PRINT"Special channel memory is ";C3M$;"."
3310 PRINT"Code store memory is ";C4M$;"."
3320 PRINT"Memory output is to ";C5M$;" Meters."
3330 PRINT"15 Meter ROBOT receiver attenuator is ";C6M$;"."
3340 PRINT"2 Meter ROBOT receiver attenuator is ";C7M$;"."
3350 PRINT"Special channel power output is ";C8M$;" Watt(s)."
3360 PRINT
3370 INPUT"HIT RETURN TO CONTINUE";T$
3380 PRINT
3400 PRINT"Main (30 Vdc) power supply voltage is";B1M;"Vdc."
3410 PRINT"2 Meter transponder power output is";B2M;"Watt(s)."
3420 PRINT"10 Meter transponder power output is";B3M;"Watt(s)."
3430 PRINT"15 Meter receiver AGC voltage is";B4M;"Vdc."
3440 PRINT"2 Meter receiver AGC voltage is";B5M;"Vdc."
3450 PRINT"Special service channel voltage is";B6M;"Vdc."
3460 PRINT"10 Meter command mode is ";B7M$;"."
3470 PRINT"2 Meter command mode is ";B8M$;"."
3480 PRINT"10 Meter transmitter temperature is";C1M;"degrees C."
3490 PRINT"2 Meter transmitter temperature is";C2M;"degrees C."
3500 PRINT"Main (30 Vdc) power supply temperature is";C3M;"degrees C."
3510 PRINT"9 Vdc power supply temperature is";C4M;"degrees C."
3520 PRINT"Backup 9 Vdc power supply temperature is";C5M;"degrees C."
3530 PRINT"15 Meter ROBOT receiver IF voltage is";C6M;"Vdc."
3540 PRINT"2 Meter ROBOT receiver IF voltage is";C7M;"Vdc."
3550 PRINT"ROBOT QSO counter indicates ";C8M$;" contacts."
3560 PRINT
5000 INPUT"WOULD YOU CARE FOR ANOTHER RUN (Y/N)";X$
5010 IF X$="Y" THEN GOTO 300 ELSE GOTO 8000
8000 END
```

Figure 1. RS-10/11 Telemetry Decoding Program.

Other Activities

What else happens at the yearly AMSAT gathering? This is not a ham convention with manufacturers, distributors and swapfest tables, nor is it a stuffy conference that puts attendees to sleep. It is more like a reunion where projects of the past year are discussed and plans for the future are presented and refined. Many of the participants only see each other once a year, at this meeting.

For those who wish, things get started on Friday night at the hospitality suite. This is also an opportunity to take care of registration and to visit with other satellite enthusiasts you may have met on the air. Opening remarks and the main program start at 8 AM Saturday morning. This is sometimes a bit early for those who got started on Friday.

Each presentation lasts between 45 minutes and an hour. Some include slide shows, films, videotape presentations or just a chalkboard and some fine oration. Breaks occur often, and coffee is usually provided. Lunch with the group is an option and is prepaid at the time of registration. Dress is casual.

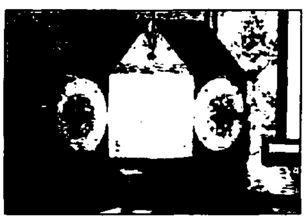


Photo C. Full-size model of the NUSAT-1, on display at the Symposium.

The Saturday night banquet is a must if you can attend. The keynote speaker in Detroit, Dr. Tony England, provided an excellent computer-generated animation of the proposed construction of the space station. The year before in Dallas, Dr. Martin Davidoff, author of the Satellite Experimenters Handbook, showed slides depicting the history of the amateur radio satellite program. Dress at the banquet is more formal than at the symposium.

The AMSAT meeting convenes after the banquet with a report on the health of the organization by the president. Awards are presented to those who have distinguished themselves with accomplishments on AMSAT's behalf. Finally the door prize tickets are drawn. In Detroit, the grand prize was an ICOM IC-475A 70cm transceiver.

Sunday continues with a few more technical sessions and the AMSAT Board of Directors meeting. This meeting is open. Sometimes a few topics are discussed privately, but the decision-making process of the corporation is open to members who care to attend. The board meeting may take a few days and put a few observers to sleep at times, but it is an important part of the organization.

Next year, we look forward to meeting in Atlanta, Georgia. Plan to attend. In the meantime, Phase 3C may be launched, new projects started, and a lot of great satellite chasing via our current group of operational hamsats will keep things going.

Telemetry Revisited

Last month I reported on RS-10/11 decoding. After doing conversions on many frames of data with a hand calculator and a chart, I decided to use a simple computer program to do the job.

The result is shown in Figure 1. It is written in VAX BASIC. I have tried to avoid using commands and routines that are peculiar to this version of BASIC, but some minor translating modifications will be required for most computers. The routines used are simple, with output directed only to the screen. Modifications for disk or printer output would be useful additions.

Pay close attention to those lines preceded by a REM-VAX comment. These lines will likely need conversion. I would be interested to hear from those of you with elegant versions of this telemetry program. Good computing!

HAM HELP

Number 29 on your Feedback card

Your Bulletin Board

We are happy to provide Ham Help listings free, on a space available basis. To make our job easier and to ensure your listing is correct, please type or print your request clearly on a full (8½ x 11) sheet of paper. Double space and use upper and lower case letters where appropriate. Also, write numbers carefully—a 1, for example, can be read as an l or an i or a 7. Thanks.

We've got trouble with an Allied SX-190 receiver and need a schematic or a service manual. Any servicing information greatly appreciated.

Bob Dickert
14126 Agony Hill Road
Grass Valley, CA 95945
916-273-9248

Where may I write for a T50-6 Toroidal Core?

Kerry Keel WA2QCJ
P.O. Box 686
Fort Mill SC 29715

I'm looking for the service manual or tune-up procedure for the DRC-40AX, transistorized version converted to 2 meters.

Robert Parna N1DUW
37R Old Bliss Road
Rehoboth MA 02769

I desperately need a schematic for an EICO Tri-Bander Model 753 and its power supply or any information on the rig's pin and voltage layout. I will pay any reasonable costs involved.

Josh Stanfield KB6SUD
23884 Gamma
Moreno Valley CA 92388

I'm seeking an owner's manual for DX-160 Radio Shack Receiver. Will purchase, copy or pay for copying of the material. For arrangements, contact:

James Wimer
16105 Rowena Ave.
Maple Heights OH 44137

WANTED: Owner's manual (copy) and/or schematic for a Lafayette 6-band communications receiver, Model BCR-101, Stock No: 99-33805W, S/N: 7611229. Will pay for copying and forwarding charges.

Nelson B. Smith
442 Locust Hill Dr.
Webster NY 14580

WANTED: Unconverted power amplifiers AM-6154 or AM-6155 in good condition.

Johnny E. Carr WA4FCC
Route 2
Rockmart GA 30153

I need the operation and/or service manual for an Alda 105 transceiver (prefer both). Also need the schematic for the Atlas RX-110/TX-110 (100 watt version). Photocopies okay.

Doug Walker N5LIP
Rt. 2, Box 16
Tylertown MS 39667

I need service information for the Allied Radio AX-190. Willing to pay.

Dick Beckham W7FVM
1989 Hibiscus
St. George UT 84770

I'm looking for a copy of the Coax Handbook.

W. Stopka W9IH
5016 N. Natchez Ave.
Chicago IL 60656

The Hernando County Amateur Radio Assn. of Brooksville, Florida, has delivered a supply of updated Florida 2m repeater directories to all Florida Welcome Centers. These free directories can be obtained by mobile hams that stop at one of these centers. Directories will be dispensed at the desk on request. Free copies will also be sent to anyone sending a request and a SASE to:

Repeater Directory
HCARA
P.O. Box 1721
Brooksville FL 34601

VISIFAX HELP WANTED: In 73's Oct. 86 article "Just The FAX, Ma'am", the VISIFAX program allows print out to a Gemini 10X Printer. I need help in the UTILITY program to be able to print to a Commodore 1525 printer.

Richard T. Dieckhaus W0MSP
7159 Juana Drive
Millington TN 38053

Number 31 on your Feedback card

PACKET TALK

Latest in Digital Hamming

Brian Lloyd WB6RQN
19200 Tilford Way
Germantown MD 20874

THE HEART OF PACKET

Happy Valentine's Day! This month I'm going back to the heart of packet radio with an examination of some of the current crop of narrow bandwidth FM (NBFM) radios that are in common use on packet. I'll also continue my discussion on improving packet radio's overall performance.

NBFM Transceiver Examination

Two months ago, I described techniques that allow you to get the most out of your TNC/radio combination. Many of the techniques described were there to correct for limitations inherent in the radios. As a result I decided to find out just how good or bad some of the current crop of radios really are.

Radios were tested for their transmitter and receiver audio frequency response characteristics. It seems that most of the NBFM radios these days conform to an equalization curve consisting of a 6-dB/octave pre-emphasis starting at about 300 Hz for the transmitter and a complementary 6-dB/octave roll-off for the receiver. Although this is different from the 75 microsecond standard, it seems to be consistent. In order to determine the relative performance, I compared the equalization curves for the receivers and transmitters to the "standard." Table 1 shows the difference between the "ideal" curve and the measured curves for the radios.

The receiver audio response curves were measured at the speaker with a known 3-kHz deviation signal generated by a calibrated signal generator. The transmitter curves were measured by injecting a signal at a fixed level that produced 3 kHz deviation at 2200 Hz (what we want for packet) into the microphone jack and the deviation measured on a Cushman service monitor. The deviation observed at 300 Hz was considered to be the 0-dB point for the relative measurements.

I was quite surprised! I expected completely horrible results in all areas. All of the radios seemed to be pretty flat in the critical 1200 to 3000 Hz range (and this after people had been telling me about how badly Kenwood radios roll-off the high frequencies). Both the Yaesu and the IC-275A had surprisingly flat receive curves. As a result I solved one packeteer's problem by bypassing the filter in the front end of his TNC's modem when it was connected to his IC-275A.

The Yaesu FT-211RH seems to have the best combined receive and transmit performance. The ICOM IC-275A is a wonderful radio for packet use if you can flatten out the transmitter response curve. I have found that many packet stations can't copy packets transmitted by the IC-275A. Clearly its transmit EQ curve needs work. I expected ICOM to get it perfect in a $1400 radio that is supposedly designed with packet radio in mind.

I want to thank the folk at EEB in Vienna, Virginia, and especially Ted Seely AA4GM for providing me with the radios, space, and test equipment to perform these tests.

How Fast Does Your Radio Switch?

When you first set up your station you probably adopted one of the more haphazard methods of setting TXDelay for your radio. One method is to use the value given to you by your friend. Another is to set it to some large value that has to work. Here's a procedure to let you find out what the value should be for your particular radio.

The equipment needed for testing is a pair of working packet stations. Be sure that you have set up your stations properly and that they work well together. (Use the techniques I outlined in the December column.)

To find the transmitter key-up time, follow these steps:

1. Leave the squelch on the receiving TNC wide open. This will allow the receiving TNC to recognize an incoming packet as quickly as possible.
2. Turn on monitor mode for the receiving TNC.
3. Set TXDELAY on the transmitting TNC to some arbitrary low value (50ms is just fine).
4. Send packets with the transmitting TNC without first establishing a connection. After each couple of packets you send, switch back to command mode and increase TXDELAY. Keep doing this until packets are received reliably at the receiving station. At this point you now know the minimum value of TXDELAY for the trasmitting station. Go back and perform this procedure for the other station.

Now you want to find out what the squelch delay is for each of the radios. The technique is the same as outlined above but just close the squelch of the receiving radio and continue with the transmissions while increasing TXDELAY at the transmitting station. The difference in the two values of TXDELAY (squelch open and squelch closed) is the squelch opening time for the receiver.

You should perform these tests for every packet station in your area so that the performance of each radio can be determined. That way you can set your TXDelay appropriately for all the stations in the area.

Some radios have a very long receiver recovery time. This means that after transmitting a packet it takes the radio a relatively long time before it is ready to receive packets again. If you find that you copy packets reliably when monitoring the channel and others seem to copy your packets reliably, but that you still can't make a connection, this is probably your problem. There is nothing that you can do to solve this problem at your station short of making major modifications inside the radio. All you can do is to get the other stations in your area to increase their TXDelay to accommodate your slow recovery time.

Making Your LAN Work Better

It is important to make sure your modem and radio work well together. This greatly improves the reliability of your packet operations. Having your own station work properly, however, is not sufficient to ensure reliable delivery of packets, because your station alone can't solve the most serious problem that your local area network (LAN) faces: the hidden terminal.

Simply stated, a hidden terminal is a station that shares the frequency with you but cannot hear or be heard by you. In all probability your packets are going to collide with those from the "hidden" station. The result is reduced throughput and longer delays, all because you cannot hear and therefore not wait for the other station to finish transmitting. Nor will he wait for you. In serious cases you will be able to hear the digipeater repeating packets, but it will not seem to hear you. In this case the signal from the hidden terminal or terminals is stronger than yours and they capture the receiver in the digipeater (I had this happen to me recently and I spent 15 minutes assuring myself that my station was not at fault).

There is a way to solve this problem: install duplex rather

Receiver Performance (error in dB)

Radio	300Hz	600Hz	1200Hz	1800Hz	2400Hz	3000Hz
ICOM IC-28H	0	8	13	13	11	8
Kenwood TM-221A	0	8	10	10	10	8
Yaesu FT-211RH	0	2	3	2	0	–2
ICOM IC-275A	0	3	3	2	1	0

Transmitter Performance (error in db)

Radio	300Hz	600Hz	1200Hz	1800Hz	2400Hz	3000Hz
ICOM IC-28H	0	0	0	–1	–1	–3
Kenwood TM-221A	0	0	2	2	2	2
Yaesu FT-211RH	0	3	4	2	3	1
ICOM IC-275A	0	4	14	12	13	12

Table 1.

than simplex digipeaters. You have used duplex digipeaters before but then you called them repeaters. The difference between a duplex digipeater and a repeater is that a repeater responds to an RF carrier and will repeat any signal in its passband. A duplex digipeater will only repeat digital signals and will not respond to voice. The recent changes to FCC Part 97 allow you to treat a duplex digipeater like a digipeater rather than a repeater (you do not have to operate a duplex digipeater under the repeater rules).

The real key to a duplex digipeater is that it repeats the signal in real time. That is, it retransmits the data at the same time it is receiving it. The result is that everyone who is listening to the output is aware of any activity on the input and will wait for the activity to cease before transmitting. There will be no hidden terminals because, in effect, all stations will hear all other stations. There is also the added benefit that there is no digipeater delay. This immediately doubles the amount of traffic that may be passed through the digipeater.

The major complaint about duplex digipeaters is cost. I usually hear people say something like, ". . . I can put up many more simplex digipeaters for the cost of one duplex digipeater. Won't I be able to support more users with several simplex digipeaters?" The answer is no. Several simplex digipeaters are NOT as efficient as a duplex digipeater. The cost is not that much greater for a duplex digipeater and the throughput is MUCH greater.

Let's examine the costs. Many items are common to both a simplex and a duplex digipeater. The common items are listed first, followed by the unique items:

Common Items:

Antenna	$100
Feedline	100
Power supply	75
Miscellaneous	50
Total:	$325

For a simplex digipeater:

Radio	$350
TNC	130
Total:	$480

For a duplex digipeater:

Receiver and enclosure	$275
Transmitter and enc.	275
Duplexer	470
Control circuitry	100
Total:	$1110

Based on these assumptions the cost for a simplex digipeater is $805 while the cost for a duplex digipeater is $1445. Based on this estimation, a duplex digipeater costs less than two simplex digipeaters.

Which One?

Which approach, however, supports the greatest number of users and moves the most traffic? Since the duplex digipeater never has any digipeater delay it automatically nets you a throughput improvement of 100%. Right there the cost-per-bit-per-second is less for the duplex digipeater.

Now we should consider things in terms of the type of network represented by the two approaches. A network based on the simplex digipeater most closely resembles ALOHA, which means that you don't bother listening, you just transmit whenever you want to. The duplex digipeater is best modeled by Carrier Sense Multiple Access (CSMA), which means you can hear everybody else, so you wait until a station has finished sending before you begin to transmit.

When there are many users on the channel ALOHA has a best-case throughput of 18%. CSMA (of the 1-persistant variety used in most of our TNCs) has a best case throughput of about 54%. Right there you have a three-fold improvement of the duplex digipeater over the simplex digipeater. Combine that with the lack of a digipeater delay, and you net at least a six-fold improvement in capacity with a duplex digipeater during busy times. So, a duplex digi gives up to six times the improvement for less than twice the cost of its simplex brother. With the advent of p-persistant CSMA (offered standard on the Kantronics and AEA TNCs and on the TNC-1s and TNC-2s with the KISS firmware—see the sidebar) you do even better than that.

The Practical Side

What does it take to build a duplex digipeater? Far less than what's required for a voice repeater! Since here we deal with essentially pure tones and can regenerate the tones at the repeater site, the control and processing circuitry is very simple. I just recently completed the construction of a duplex digipeater. Its control circuitry consists of a surplus Bell 202 modem, two transistors, an op-amp, and a handful of resistors and capacitors. No squelch is used with this setup, since the modem does a superb job of detecting the presence of packets. No tail timer is provided so the transmitter drops just as soon as the modem detects that the signal is gone. A very simple time-out timer is also provided. The ID is provided by a TNC sending a beacon on the input frequency.

How well does it work? Quite well. I ran a test the other night to see how much data would get through on a heavily loaded LAN. To perform this test I had three stations engage in file transfers simultaneously. Even with header overhead and the occasional collision, throughput was 93 bytes/second. On a 1200 bps channel this represents a throughput of almost 64% of channel capacity. This is considerably better than a simplex digipeater. When we tried it with a simplex digipeater the test failed. We could not even keep the connections established.

If you are looking for a reliable and efficient way to create a LAN where everyone can communicate effectively, this is a good solution. The only real alternative is to operate simplex without digipeaters and to make sure that everyone can hear everyone else—a viable alternative for a small town but not very practical for a large area such as a county or a large city.

Some time in the not-too-distant future I will see to it that the design for the duplex digipeater control circuitry appears either as an article or here in this column.

That's it for another month. I want to thank those of you who have written to me about the column. I really appreciate your encouragement. I encourage the rest of you to write with questions, comments, kudos, or brickbats. See you next month.

"Persistence" is a technical term describing the probability of a station with traffic transmitting when the channel goes clear. Right now most TNCs operate with 1-persistent CSMA. This means although a station will wait politely for another station to finish transmitting, the station will always transmit when the channel finally goes clear. The DWAIT parameter in your TNC is an attempt to prevent all stations from transmitting at once, but it introduces its own set of problems.

The problem with 1-persistent CSMA occurs when there are two or more stations ready to transmit. When the channel finally clears, they both transmit at the same time virtually guaranteeing a collision. To alleviate this problem p-persistence allows you to assign the probability p to the likelihood of a station transmitting when it has traffic to send.

In operation, when the channel clears, instead of immediately transmitting, the TNC generates a random number between 0 and 1. It then compares the generated random number with the value of p. If the generated random number is less than p then the TNC keys the transmitter. If the generated random number is greater than p the TNC waits for a period of time (called slot time) and then tries again. Slot time is selected to be longer than the time it takes for another station to key up and capture the channel.

Let's go back to our previous scenario and see what happens if both stations now run p-persistent CSMA with p set to the value 0.5:

1. Neither A nor B transmit (both generate a random number greater than 0.5)
2. A transmits and B waits
3. B transmits and A waits
4. Both A and B transmit.

Here the probability of a collision has dropped from 100% to only 33%. Imagine that you could have 3 times fewer collisions in your LAN. That means three times fewer retransmissions and greatly improved throughput.

The best value for p is a function of how many users there are on the channel. A good starting point is $p = 1/(n-1)$ where n is the number of users on the channel.

Both AEA and Kantronics have implemented p-persistence in their TNCs. If you have the option, ALWAYS use p-persistence instead of DWAIT.

Number 32 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

FCC Film Flam

Well, a look around will show that the emphasis this month is on QRP. This is a digitally inclined column, so let's look at our low power digital transmitters—computers!

What do computers have to do with transmitting? Well, folks, other than the obvious uses for RTTY, packet, AMTOR or CW terminal, a lot!

Over the past few months I have been looking at computers. I've been focussing my search on IBM PC clones. Now, there are many items to look at in the ads—how many deca-K of RAM, the number of ports, or whether the display is compatible with a greek god. But tour little words that caught my eye, and maybe yours, in many of the ads: "FCC Class B Approved." I started to wonder just what that meant.

My quest led me to the local field office of the FCC to ask the big question "What is Class B approval?" and its corollary "Is there a Class A, and do I want it?" What I found out may well surprise some of you, and will interest all of you who have a hand in computing.

Subpart J of the FCC regulations deals with computing devices. In subsection 15.801, the scope of this subpart is laid out saying, "Computers and similar electronic equipment that use digital techniques generate and use radio frequency (RF) energy for timing and control purposes. Unless proper precautions are taken, some of this RF energy is radiated into space or conducted along the power line (or combination of both) and may cause harmful interference to radio communications. This subpart sets out technical and administrative specifications to reduce the interference potential of such equipment."

It sounds like the FCC is on our side, right? Read on.

Class A computing devices aren't specifically defined. They appear to be many medical computers (not office management systems) such as CT scanners, and thrillers in the ilk of coin-operated video games. Emanations from these devices are held to tight limits (see Figure 1). Note that the lowest specified frequency measurement is taken at 30 MHz, so that the VHF and UHF bands are the most affected.

Class B computing devices are those near and dear to us. Personal computers, computer peripherals—even digital watches and calculators—are Class B devices in the FCC's eyes. Let me dispense with your concern over your watch quickly, though, as labeling regulations dispense with the requirement on an "extremely low power, miniature computing device, such as an electronic digital watch." Just as with Class A computing devices, strict field strength measurements are required for Class B certification (see Figure 2).

You might note an interesting comparison. The measurements for Class A devices are specified at a distance of 30 meters, while those for Class B are at 3 meters. That, coupled with the different field strengths, somewhat obscures the magnitude of these regulations. But, the FCC in their infinite wisdom, says that for Class A devices, "Measurement for compliance with these limits may be made at a closer distance, provided the test results are compared with the limits at 30 meters using the relationship: E30 = Ed (d/30) where, E30 = computed field strength in microvolts per meter at 30 meters; Ed = measured field strength in microvolts per meter at the distance 'd' meters; and d = distance in meters at which the field Ed was measured (less than 30 meters, but greater than or equal to 3 meters)."

Now, if you take the allowable limits for Class B devices at, say, 30 to 88 MHz, 100 µV/m at 3 meters, and plug them into the above formula, you get E30 = 100 3.30 = 10. Allowable field strength for Class A would be 30 µV/m, at 30 meters, but for Class B only 10! What appears at first glance to be looser limits for personal computers is, in fact, tighter! This is important because if someone tried to bamboozle you into believing that Class A approval is better than Class B, well, now you know better.

Letters Dept.

I have here one of those "last resort" letters I get from time to time. It's the type that say that the individual has looked everywhere for something, been unable to find it, and I am his last resort. I don't know, sometimes we get lucky. This time, though, I will have to punt to you all. Maurice Kerr, of Aberdeen, MD is looking for software to display weather FAX on a MacIntosh 512K computer. I nosed around a bit but couldn't come up with anything. Any help out there? I'll publish what information I turn up for all to benefit.

Okay, folks, who can help an enterprising RTTYer? Ralph Della Rocca WA2STO, of Oakland, New Jersey, has been working on his RTTY WAS, but is five states short. He appeals to all RTTY-o-active hams in South Dakota, Hawaii, Vermont, New Hampshire, and Rhode Island! Drop Ralph a line at 22 Hillside Avenue, Oakland, NJ 07436, if you can set up a sked. Good luck, Ralph, and let us know when you make the big Five-Oh!

Now for AMTOR. I received a question via CompuServe Easy-Plex the other day from Bud Holzschuh, of Friendswood, Texas. He recently acquired a PC clone and is totally satisfied with it except for one problem—interfacing it with his AEA CP-1. "It's easy to find programs to run CW, RTTY, and ASCII," says he, "but not AMTOR!" "No one has all-mode software for the PCs on a 'dumb' interface."

I'm sorry to say I don't know of any software AMTOR routines. Not sure if it is all a hardware or software problem, but I agree, there's either no such animal, or he's hiding pretty well. Perhaps the readers can help out. So far the PK-232 has a corner on the all-mode interface deptl

J.J. Falkanger KF4VE is another ham who sent a question via CompuServe. He has questions about the PK-232 ranging from the simple "how well does it work" to some details on the WEFAX output. his questions show the phenomenal interest in this end of the hobby.

Well, J.J., I am truly impressed. Transmitting is clearly no problem. Receiving has always been the bug-a-boo at my station, and my history goes back to a homebrew W2PAT convertor, as well as an ST-6, and several others in between—both commercial and amateur versions. By comparison, the PK-232 ranks up with the best of them. I have not found a signal that could not be copied if it was a copiable mode and if the signal could be heard.

The WEFAX reception is also remarkable. The picture I printed here was produced here at WA3AJR on a plain Epson-type printer, from the bounding signal the Navy sends up here from Norfolk. He tells me that new software allows direct display on PC screens, obviating the need for so much paper. Sounds like a good idea to me. Good luck, and let us hear from you as you progress.

Here's some hellos to the faithful readers of this column. I received quite a bit of mail over the past month or so. To Dr. James Wilson, Frank Krushina K4DW, Robert DeVaughn K3NBD, Howard Swertfager WA2ORX, Cliff St. John WA8AWU, Darrel Daley KL7DN, Jack Bentley KC8FR, Tim French KA9WDJ, Ken Taylor KC5IX, Hal Pressman KD8SY, Ray Pitts N6HDU, and all the others who have written in with this or that, thank you! It is your interest that keeps me hopping, and this column moving along.

I continue to look forward to your questions. Postal inquiries go to the address at the top of the column, and should be accompanied by a self-addressed, stamped envelope (SASE). Electronic mail is welcome via CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR).

Frequency (MHz)	Distance (meters)	Field Strength (µV/m)
30 to 88	30	30
88 to 216	30	50
216 to 1000	30	70

Fig. 1. FCC Class A device radiation limits.

Frequency (MHz)	Distance (meters)	Field Strength (µV/m)
30 to 88	3	100
88 to 216	3	150
216 to 1000	3	200

Fig. 2. FCC Class B device radiation limits.

Number 33 on your Feedback card

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

The QRP 5er

When I was a Novice, a good friend of mine always told me to look into all those coffee cans and cigar boxes at a hamfest for hidden goodies. Well, Joe was right. At the Dayton Hamvention last year, I found a small circuit board that would become this month's project: the QRP 5er.

The name may be a bit misleading. It is not a transmitter, but a five-amp power supply. Working the world with a watt or two of RF eliminates the need for large bulky power supplies. The addition of a few more parts, and you can turn the power supply into a battery charger to keep those portable rigs perking.

The small circuit board that I found at the hamfest was a pre-regulator for a color monitor. Some guy had a box full of these boards under his table. I asked what they are and the stories started. Seems that he got the monitors from a company that made terminals for hospitals. The hospital did not want the color monitors, so he bought them in a large lot for a good price, and was selling them out like hot cakes at the hamvention. So what of the boards? Seems that the company that made the monitors was to use a 24-volt supply, but the monitors work on 13 volts. The boards were to regulate this voltage down. Since the monitors worked on 13 volts, he separated the pre-regulators from the chassis and sold them for five bucks each. The pre-regulator boards can regulate up to six amps of current. With a bit of bargaining on both parties, I walked away with a board for $2.50.

I tossed the board into a junk box after I returned home. A few weeks later, I dug it out and began the look it over. With only a few external components, the heart of this pre-regulator seems to be a adjustable voltage regulator, an LM338K to be exact. Looking the part number up in one of the catalogs that I have, it seems that the LM338K is a six-amp adjustable regulator, with a list price of $7.35. Guess I did get a bargain after all. Since the board had all the interface parts needed, I use the board as a basic building block for the power supply. Because buying the LM338K would make the project much more expensive than I would like, I'll show you how to use the LM317K, a different type of regulator. It doesn't handle as much current, but it is a lot cheaper, and you can get the TO-220 case LM317T from your local Radio Shack store.

As with all the projects that I build, nothing is cast in concrete. Substitute parts for what you have on hand, not what I have in my junk box. One of the first things we need to dig up is the power transformer. Since we will be needing at least 12 volts output, we need about 18 volts from the transformer, because the regulator requires a 5-volt buffer. When a load is connected to the supply, the regulator will hold the output at the preset voltage. If there is not enough voltage from the transformer, the output voltage will drop. That's the reason for the required 18 volts.

What Transformer to Use?

What to do if you don't have an 18-volt transformer in the old junk box? First you can go to Radio Shack and buy one—they sell an 18-volt 3-amp job for about $8 (a bit high for me). You can take one 12-volt transformer and tear it apart and rewind the secondary for a higher output, but that's really a lot of work. Fine if you're up to it, but time is money and I don't have the money for that! If you have one six-volt transformer and one 12-volt transformer, you can wire the secondaries up in series to obtain the needed 18 volts. Just connect the transformers in series and check for the proper output with a voltmeter. If you get nothing, reverse one set of leads on one transformer.

> ***"Use wits instead of watts!"***

You can also use a 24-volt transformer. I don't recommend them, however, since the excess voltage has to be dissipated as heat from the regulator.

Lastly, you can get away with using a 12-volt transformer. It's possible as long as you don't load the output down too hard. The peak-to-peak output from the bridge rectifier charges up the filter capacitor to its maximum voltage. The capacitor then acts as a buffer. If you try to pull too much current, the capacitor can't supply the regulator with enough voltage, and the output sags.

Speaking of Filter Capacitors

There's a formula for calculating the needed value, but why bother? The more the merrier. Use the maximum capacitance you can muster. Watch the capacitor voltage; get one rated at at least 30 VDC. If you can't find one capacitor to fit the bill, you can always add capacitors in parallel to increase capacitance (again, watch the voltage ratings). All of the capacitors should be rated for same voltage.

Between the filter capacitor and the transformer is the rectifier. I used a 10-amp unit with a voltage rating of 200 VDC. The entire unit is encapsulated into a small square about the size of a postage stamp. You can use individual diodes if you like, mounting them on tie strips. Go for a three- or six-amp rating. If you plan on using the supply for powering milliwatt rigs, use the very common 1N4002 diodes, rated at one amp.

Let's now look at the regulator. Pass transistors were in common use in the past, and still are in large, high current power supplies. Lucky for us, we don't need that kind of current. The LM338K will pass six amps. You can adjust the output voltage. The regulator is both current and temperature protected. You can even short the output to ground and the chip will just shut down with no damage. As I said in the beginning of the column, you don't have to

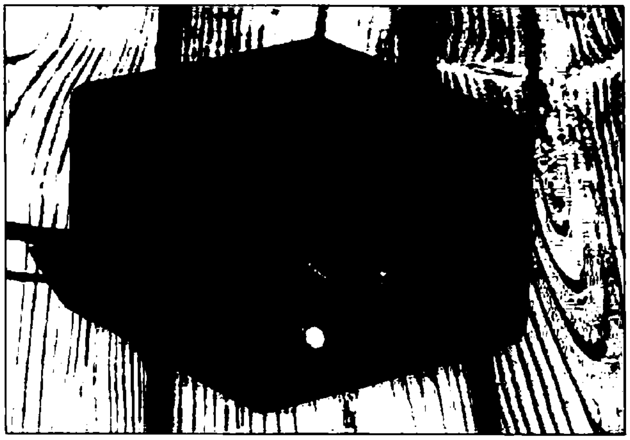


Photo A. The QRP 5er—A small 5-amp power supply just for the low-power operator.

Photo B. Inside the supply. Note the Molex connector for input and output connections. Filter capacitor in foreground.

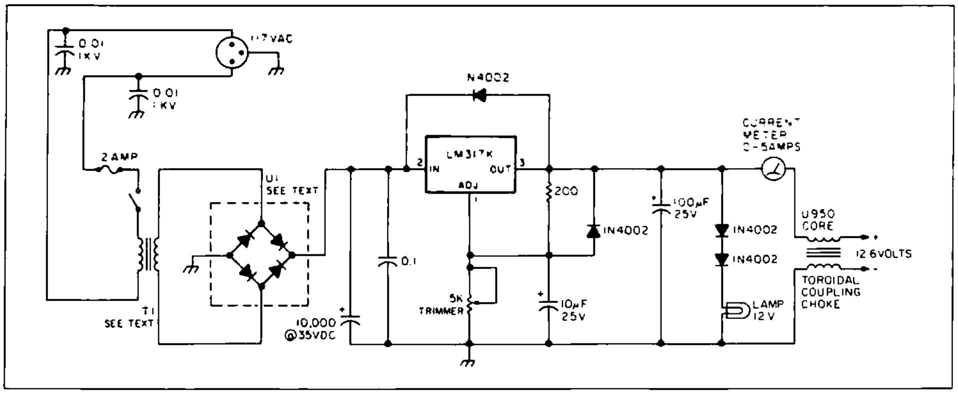


Figure 1. The schematic for the power supply. The core for the filter on the output can be just about anything. Use a large toroid or a ferrite rod.

use the LM338K. The LM317K has all the features of the LM338K, but can only pass 1.5 amps of current. That is still quite a bit current for the QRP operation most of us use.

Take a Look

Look at the photographs of the completed QRP 5er. You can get some idea on how I put it all together. Since I already had the pre-regulator board with the required LM338K, I mounted it on the inside rear of the cabinet. The heat sink is clearly shown in the photos. While the LM338K can pass six amps of current, the heat sink that is on the board will not supply enough cooling for the regulator. That's fine since I don't plan to pull that much current from the supply for any amount of time.

A Molex connector supplies the output from the rectifier/filter/transformer combination to the pre-regulator board. The regulator outputs via the same Molex connector. Small plastic standoffs are used to mount the board. Since I don't have access to more of these boards, it's a one-time shot. Since you don't have one of the pre-regulator boards, try to mount the regulator on the outside rear of the cabinet. Even without an extra heat sink, the metal cabinet should provide more than enough surface area to keep the regulator cool. Mount the remainder of the parts with tie-strips. Don't forget to mount the bridge rectifier on the chassis if you plan to use an encapsulated unit. If you plan to use individual diodes, they can be mounted on tie-strips, leaving plenty of lead length so the diodes will be able to cool themselves by convection.

Photo C shows the rear of the power supply. Notice the extra switch hole. That's for a battery charging option. It will insert a diode in series with the output and then raise the voltage from the regulator, to overcome the .7-volt drop across the diode and tokeeps the battery from being discharged by the supply. Figure 1 shows the complete schematic for the QRP 5er using a LM317K. Notice the needed by-pass capacitors and the chokes. They are needed to help reduce hum when running a direct conversion rig, such as the Heath HW-7. This is known as "common-mode hum."

Have you ever noticed how some hams put voltmeters on their fixed voltage power supplies? I don't know why. If you can't adjust the output voltage, why put a meter on it? A simple lamp on the output serves as a very fine voltage monitor. I inserted a few diodes in series with the lamp to reduce the intensity of the lamp. You can of course use a resistor to drop the current to the lamp, but I have a few hundred 1N4001 diodes, and the .7-V drop from each of them works just fine. With the light monitoring the voltage output, if the output sags, the light will dim.

You can easily tell if something is wrong by keeping an eye on the output lamp. If it doesn't light at all, you may have a bug in the primary of the supply or a short on the the output side. If you just can't live without a meter of some kind on the supply, then by all means, add a current meter. That will prove most useful when trouble shooting a transmitter, by seeing how much current is flowing into the transmitter. Here, you can watch for RF output to pinpoint trouble.

Most of the circuit of the QRP 5er can be changed to suit the end user. Chassis and parts size will likely determine your unit layout. Use what you have, and don't worry if you can't find the same parts as I did.

After you have everything together, look over your work for errors in wiring. Be careful dealing with the 110 VAC wiring, since you can get quite a jolt. Then, hook up a digital voltmeter to the supply output. Turn the supply on and adjust the trimmer pot for 12.8 volts. That's a bit lower than the so-called normal voltage of 13.8 volts, but reflects a closer operating voltage when running a radio from batteries. That's all there is to it! With a bit of luck, you'll have a fully operational QRP power supply to run all the upcoming projects we'll be building.

Contest Time

Winter is contest time. I received a letter from the guys up in Cuyahoga Falls, Ohio. The Crazy 8's HF, VHF & UHF contest will be held February 6 to February 7 1988. There is a special QRP section. While I don't have the space to give full details, this contest has a little bit for everyone. Even if you don't like to contest, the contests will help to fill up the logs sheets. When you're worth five points, you're always 5 x 9! These contests are great ego builders for the QRP operator.

Next month I'll look at one item that generates more fear into most hams today than the FCC could ever dream of. So until next month, remember, use wits instead of watts! ■

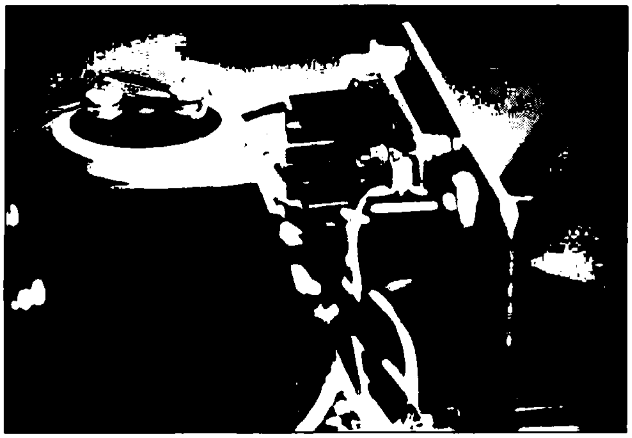


Photo C. Rear view of the supply. The extra hole is for a battery charging option.

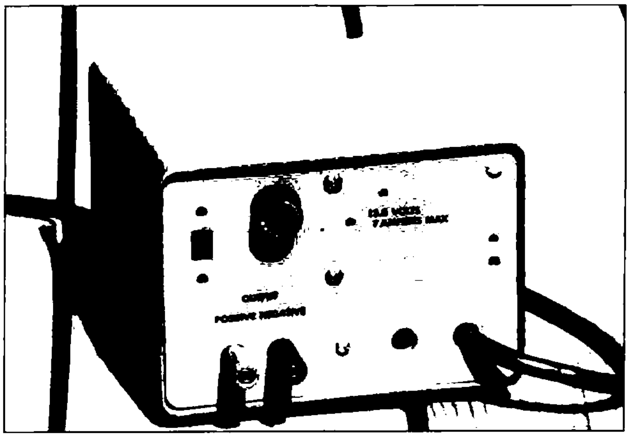


Photo D. Fuse in foreground is for the primary of the transformer.

LETTERS

From the Hamshack

What a Story!

I am a Novice of a few months, still struggling with the newness of the hobby. The word hobby does not exactly fit—it seems more than that.

I had always wanted to be a ham, but never found the time—until at 43 I became a disciplined code practioner. I became an eager Novice...but cheap. I found a somewhat-worn HW-101, tuned it up about six times, restrung, hung wires in the trees, took a deep breath, and tapped out the shakiest CQ on record.

I got a used (of course) HD-10 keyer and paddle. With my 40 watts, (approximate, since the power meter's also seen better days) I started to conquer continents on 15 meters. Awed nearly to disbelief, I worked Brazil and once even the Canary Islands! So what? Well, try to remember when you were a young and callow ham.

One evening I had a nice long QSO with a fellow from Veracruz in Mexico, XE1AKE. I was really impressed with his signal when I learned he was operating at five watts on a home brew using a vertical built in the cellar. We exchanged QSLs—his had a request.

He wrote that he was partially through a project from *73*, a one watt CW transmitter (what else?), when his car was stolen. Now he can't finish the project because his car's been stolen. How's that? Well, the magazine was in the back seat. And back issues are hard to find in Mexico.

So I called *73* and spoke to an editor. She made it very clear that they would not replace the car but that she would get a copy out to me right away to send to Mexico. Well, I talked to her yesterday, got the magazine today and am mailing it tomorrow. Let's hear it for cheerful, considerate service.

I had a lot of fun, got to talk with some nice people and had a chance to help a fellow ham. I think I'm going to like ham radio.

Joseph G. Fitzpatrick
Milford MA 01757

We always like to hear that we've helped someone out, and we always take time out to lend a hand when we can. I wonder what would happen if everyone did one good deed each week for a fellow human being. Let's try it and find out...de NA5E.

And Still Waiting

Your November "Never Say Die" really expressed what I've been feeling for the 2½ years I've been a ham. Very little real communication takes place, especially with stations outside the US. Your ideas sound good, but there is a flaw in your reasoning about DX communications. It would be nice to draw the other station out and to find out about him or her. Yet, invariably the response is, "Many stations waiting, old man. Thanks for the call. QRZ?" It seems like every DX station has a pileup—even stations in Great Britain (which anybody on 20m has worked at least 5 times). There really *are* "many stations waiting!"

Just what the thrill of exchanging "5 by 9" is, I don't know. In the days when we built our own equipment, maybe there was a pride in knowing they could hear you, but what makes my Kenwood or Yaesu better than the next guy's? Has the low propagation made DXers so hungry for any non-US contact, or is it merely force of habit? Of course, if the DX Op would ignore those stations and have a real conversation, that would solve the problem, but there is a lot of pressure on him to hand out contacts.

If you have any ideas regarding how to get the other station to *want* to talk, please tell me what it is.

Michael Jay Geir KB1UM
S. Burlington VT

Michael, I've seldom had a problem getting DX ops to talk to me. The strategy is simple: Ask them a question that gets them interested in talking. My opening is simple—I'm hoping to visit their country/city/town and would enjoy meeting them. I not only get a phone number to call if I get there, I get a description of their area and plenty of attention. I get a real contact instead of just a QSL. Now don't steal my gambit, you think up something of your own to ask that will get them talking...Wayne.

Dear Mr.

As General, Advanced, and Extra Class you have 12 groups of frequencies for talking. Novices have 3 restricted-to-death areas people begrudge them. It must stem from an abuse cycle—the good old days of the gagged Novice you had to endure, and having to know everything a General did to pass Technician. Seeing the Novice class change and Tech get easier must make you steam. How dare *they* get things handed to them—like voice. So you feel you must abuse and insult these people so that they will know the worth of the abuse you took in the dark ages of amateur radio.

The dark ages are gone, but you wish to keep the Novice in bondage to an ancient way of life—out of step and foolish. Ours is a keep-pace, high-tech, and stress-filled world. Amateur radio was supposed to be a hobby that benefits the operator and the public at large—not a private thing to be hidden, kept secret, and hogged. Instead of encouraging wide-eyed Novices of many ages, sharing knowledge, and gaining new friends, you choose to keep yourself isolated, unknown hermits in a high-tech hobby.

We recognize your accomplishments and your hermit pals know who you are, but does the guy down the street or that wide-eyed kid you passed just a moment ago? In most cases, no. And your accomplishments—unknown and lost forever. What pride is there in being unknown—your knowledge and skills dye with you. A sad waste—skilled Masters of Amateur Radio, artist and art, lost and being lost every day. Silent keys, an unkeyed mike—no one there to pick up the mike or pound the brass after you're gone. Novices are eager and willing to listen and *can* apply themselves. *If they* couldn't they wouldn't be trying to enter a hobby from which selfish and heartless people are trying to exclude them. Are you a teacher or a silent master with no apprentice?

Amateur Radio
(The Next Generation)

Guilty as charged! The Grand Order of Ignoble Amateur Radio Operators have perpetrated the arrogant notions of elitism and fraternal pecking order long enough. The Next Generation will soon leave them long behind in death (see "Silent Keys" in QST) or in ignorance, whichever comes first. At the same time, let's not forget the thousands of unsung Elmers, who have kept this hobby alive and growing despite the efforts of others. Live long and prosper...de NA5E.

Anybody Home?

I have been an amateur radio operator since November of 1982. I presently hold an Advanced class license. On 10/03/87 I checked into a late net on 75 meters. During the course of the net a station in Tennessee made his call to a station in Hawaii. After an unsuccessful first attempt, the net control station and two relay stations across the country told the KH6 to "listen for a call." At the end of the second transmission the net control started a relay of "overs" and "send a string of numbers" back to the KH6. After a relay of "overs" came back from KH6 the 2 x 2 QSO was confirmed by the net control station.

It appears very obvious from the set up of relays across the *country* that neither station heard the other, but a standard 2 x 2 report on each end was enough to get a "roger contact" from the net control. I am working for my WAS and would like to get it very much, but not under such operating practices. If this is what getting a certificate is all about then it truly is *wallpaper*.

After questions were asked about the validity of the contact by this station and others, Tennessee asked net control to withdraw his contact, thus helping to restore some faith in the ethics of amateur radio operators. This makes me wonder how many contacts have been made under similar circumstances and have not been questioned as this one.

I hope this note reminds amateur radio operators that this is a hobby, for fun—you are not a better operator just because you have a lot of paper hanging on the wall.

Gary Mascelli, Jr. N3DLM
Wilmington DE

To claim credit for clearly incomplete contacts is dishonest at best, no matter what method an operator may use. The fundamental problem is not new, nor is it limited to amateur radio. If any operator gleans satisfaction from dishonest practices, whether his own or someone else's, he joins the ranks of universal sleaze bags, unworthy of anything more than a turn of the dial...de NA5E

Number 35 on your Feedback card

Dx

Hams Around the World

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

Three Ways to Find Solar Minimum

Solar research uses three measures to pinpoint the solar minimum. The most obvious is the number of sunspots: when that number is at its lowest point in the 11-year cycle, we are at the solar minimum. Short term fluctuations in solar activity, however, make the monthly sunspot count gyrate from near zero to the high 30s. For example, the sunspots counts for September and October 1986 were 3.8 and 35.4, respectively. That's an increase of a factor of nine in a single month!

Researchers smooth out these month-to-month variations by using a 13-month moving average. The smoothed sunspot number for a given month is the average of the sunspot counts for 13 months centered on the given month, including six months before and six months after that month. This means that scientists (and DXers) cannot determine the smoothed sunspot number for six months after the month in question.

The smoothed sunspot count dipped to 12.3 in September 1986, its lowest value in 10 years. Since sunspot cycles usually bottom out at much lower sunspot numbers (5–7 is more typical), some solar experts hesitated to call the September figure the true bottom of the cycle. However, after September, the smoothed sunspot value began to increase, doubling to 24.2 in only seven months.

A second method to determine solar minimum uses the cycle period. Solar cycles average 10.9 years in length. Since the last solar minimum occurred on June 1976, we should have reached another minimum in mid-1987.

This system is limited, though, by the cycle's irregular period. Solar cycles have ranged in length from as little as 7 to as long as 17 years, so this method can provide a rough approximation of the bottom at best.

Mixing Old and New

A final way to identify the solar minimum is when "new" and "old" cycle sunspots are approximately equal in number. How can you tell the difference between new and old cycle spots? During a solar cycle, sunspots first appear at high solar latitudes, 30 degrees or more north and south of the solar equator. Over the next 11 years, new spots tend to form ever closer to the solar equator, so that near the end of the cycle, what few spots arise tend to lie clustered close to the center of the sun.

Further, the magnetic field of the sunspots reverses with each new cycle. Thus, "new" cycle spots have a magnetic orientation opposite to that of the spots near the solar equator. This means sunspots associated with the upcoming cycle can be easily identified.

Sunspots from the two cycles tend to overlap for about two years. We begin to see new cycle sunspots about a year before solar minimum. At the minimum, the numbers of new and old cycle spots are about equal. After the minimum, new cycle spots predominate.

The first Cycle 22 spots appeared in August 1985, which gave DXers hope that the solar minimum was only about one year away. However, few Cycle 22 spots appeared over the next few months, giving rise to the fear that the first spots were more similar to a groundhog predicting six more months of solar Winter than a robin heralding the coming solar Spring.

Cycle 22

Through the fall of 1986 and into spring 1987, the number of sunspots continued to increase, and most of the increase came from new cycle spots. The number of old cycle spots dwindled down to near zero, an excellent indicator that we had, indeed, passed solar minimum.

Why all this concern about when the cycle bottomed out?

Because predictions of the next solar cycle are very dependent on the exact date of the minimum. When will the sunspots be high enough for world-wide 10-meter propagation? Will the maximum usable frequency rise high enough to open 6 meters? The answers to these questions hinge on the date of the sunspot minimum.

Based on the September 1986 minimum, solar researchers have predicted a sunspot maximum for Cycle 22 of about 120, to occur in early 1991. This number is way down from the peak of 165 we enjoyed in December 1979, the last solar maximum. The low predicted value is based on evidence that even-numbered cycles are lower and flatter than odd-numbered cycles. This difference may reflect a 22-year sunspot cycle, rather than an 11-year cycle. Some solar scientists feel that a full solar cycle consists of two peaks and two minimums. The full cycle thus incorporates two 11-year cycles. (See Sky and Telescope, June 1987, for more details.) The even numbered cycles (18, 20, 22, etc.) have been characterized by lower peaks than the odd-numbered cycles, which leads to the prediction for a sunspot peak in the 120 range.

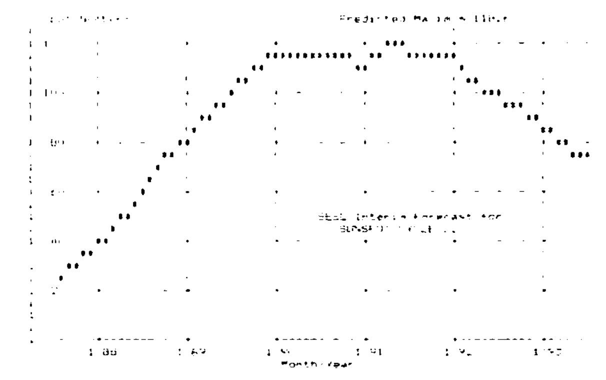
Looking Ahead

The good news for DXers is that the even-numbered cycles rise quickly to their peak, and stay at high sunspot levels for several years. The predictions for Cycle 22 have the sunspot number climbing to the 120 range as early as the end of 1989, and staying that high until early 1992. Although this is probably not enough sunspots to open 6 meters on a regular basis, 10 meters should be excellent throughout this period of high solar activity.

More good news for DXers is that the sun is running well ahead of predictions in Cycle 22. The smoothed sunspot number jumped to 24 only six months into the new cycle. The only other sunspot cycles that climbed so rapidly at the beginning went on to produce record-breaking sunspot numbers at their peak.

It's still too early to say whether Sunspot Cycle 22 will be another great one, such as the late-50s peak, or the one in the late 1970s.

For more information on solar cycles and prediction methods, see Shortwave Propagation Handbook, by George Jacobs W3ASK and Ted Cohen N4XX. Also, WWV transmits solar activity data at 18 minutes after the hour. Modem-equipped DXers can obtain current solar data, summaries of the previous month, and predictions of Cycle 22 by calling The Space Environment Services Center data line 303/497-5000 at 1200 baud, 8 bits, one stop bit, no parity.



Month	SSN	Month	SSN	Month	SSN	Month	SSN
1/87	16.[illegible]	1/89	81.4	1/91	111.8	1/93	85.5
2/87	17.[illegible]	2/89	84.9	2/91	11[illegible].8	2/93	82.9
3/87	18.6	3/89	88.1	3/91	115.[illegible]	3/93	80.5
4/87	19.9	4/89	91.2	4/91	118.0	4/93	78.5
5/87	21.5	5/89	94.[illegible]	5/91	118.6 •	5/93	76.9
6/87	23.[illegible]	6/89	97.2	6/91	118.0	6/93	75.5
7/87	24.4	7/89	100.[illegible]	7/91	117.[illegible]	7/93	74.2
8/87	26.3	8/89	102.9	8/91	116.1	8/93	72.5
9/87	28.5	9/89	105.2	9/91	114.[illegible]	9/93	69.7
10/87	[illegible]0.4	10/89	10[illegible].7	10/91	11[illegible].0	10/93	67.4
11/87	32.2	11/89	11[illegible].[illegible]	11/91	11[illegible].[illegible]	11/93	66.8
12/87	[illegible]5.9	12/89	11[illegible].5	12/91	11[illegible].[illegible]	12/93	64.2
1/88	39.2	1/90	114.6	1/92	112.8	1/94	65.5
2/88	41.[illegible]	2/90	11[illegible].4	2/92	1[illegible].4	2/94	64.5
3/88	44.5	3/90	11[illegible].[illegible]	3/92	10[illegible].1	3/94	63.[illegible]
4/88	4[illegible].8	4/90	114.[illegible]	4/92	10[illegible].[illegible]	4/94	61.8
5/88	51.1	5/90	114.8	5/92	1[illegible].[illegible]	5/94	59.4
6/88	5[illegible].1	6/90	114.4	6/92	10[illegible].[illegible]	6/94	56.2
7/88	57.8	7/90	11[illegible].9	7/92	98.[illegible]	7/94	[illegible]
8/88	64.[illegible]	8/90	11[illegible].9	8/92	9[illegible].[illegible]	8/94	5[illegible].[illegible]
9/88	68.2	9/90	114.7	9/92	96.4	9/94	49.9
10/88	[illegible].6	10/90	114.8	10/92	[illegible]4.9	10/94	46.6
11/88	7[illegible].[illegible]	11/90	114.[illegible]	11/92	91.8	11/94	46.8
12/88	[illegible].9	12/90	11[illegible].4	12/92	88.6	12/94	44.7

• denotes maximum

Figure 1. Graph and table of sunspot numbers for Sunspot Cycle 22 for January 1987 to December 1994 (courtesy of Space Environment Services Center).

Number 36 on your Feedback card

QTH DX

QTH is Nauru

We welcome N6HYK's new, regular feature to our pages. Mr. Fletcher is a professional writer and an active ham. He has traveled to more than 160 countries. Through his efforts, we hope to fill you in on some of the more interesting aspects of those rare DX spots...Ed.

Leon Fletcher N6HYK
274 Webster Dr.
Ben Lomond CA 95005

When you work a C21, Nauru, you're in touch with a resident of the country with the highest per-capita income in the world—*and almost none of its citizens work!*

While it is rather widely known that the wealth of Nauru comes from mining the island's high-grade phosphate—bird droppings—few outsiders know much about the impact that valuable resource has made on the islanders.

The phosphate has come from uncountable birds nesting on the island for millions of years. Nature has mixed the phosphate with the island's coral to produce a truly superior fertilizer.

The deposits cover about a third of the island—but are expected to be completely mined out in the mid-1990s. By then, however, if the government's plans work, every citizen should be a millionaire.

Every year the government invests some 60% of the mining profits in such adventuresome projects as:

Air Nauru, an airline that carries passengers first-class only.

Five (at last count) cargo ships operating under the flag of the Nauru Pacific Shipping Line.

The tallest building on Saipan, a 7-story structure topped with the only revolving restaurant in the far Pacific.

And the tallest building in Melbourne, a 51-story office complex called by Australians—in salute to the source of the funds for the structure—"Birdshit Tower."

The other 40% of the income is distributed to the citizens of Nauru. Housing, education, hospitalization, and such are all free. Postal rates are the lowest in the Pacific. The per capita income is $21,400—more than 83% higher than the $11,675 in the United States. The Nauruians pay no taxes.

With such riches, few of the 4,500 Nauruians work. The mining—and virtually all other work on the island—is done by some 3,500 hired hands from other Pacific islands and from China.

Some Work, Some Play

While those workers toil, Nauruians play. The QSL card of *C21RK*, Reuben (Jim) Kun, features the drawing of the large bird and this printed note:

"The frigate bird is native to the Pacific Islands. Traditionally, they are caught and tamed by Nauruians. They are then kept as pets. The tame bird can fly long distances and bring back other wild frigate birds, which are then caught by a weighted line."

Another diversion that attracts bored Nauruians is the island's airline. The *nouveau riche* islanders frequently squander their funds on one-day, round-trip flights to neighboring islands. Once there, many of these travelers don't bother to sight-see, shop, dine out, or do any of the other usual tourist activities; they often do nothing but hang around the airport, waiting for a return flight. According to travel writer David Stanley, Nauruians consider the trips "one way of passing the time."

"They could easily buy another island for themselves."

Island Paradise?

The island's single road, which has only a few offshoots, is often jammed with large American cars and 4-wheel-drive Jeeps. Super-loud, raucous music blasts from stereos, shattering the peaceful atmosphere of pristine beaches. The supermarket sells a great variety of imported junk food. The result: many Nauruians are obese. In Stanley's view, "There is widespread evidence of affluence and accompanying wastage."

At eight square miles, Nauru is the third smallest country in the world. Only the Vatican and Monaco are smaller. A major activity for visitors is to walk around the entire country—but that takes only about four hours. The island is 12 miles in circumference, oval-shaped, surrounded by a coral reef visible at low tide. Inside the reef is a beautiful beach of sparkling white sand. Seaward, the bottom drops away at a startling 45 degrees. There is no harbor, but the 30,000-ton ships calling regularly to carry away Nauru's valuable resource tie up offshore at what are claimed to be the deepest moorings in the world.

The island is located in the Western Pacific, some 5,400 miles southwest of California, 1,300 miles northeast of Australia, 30 miles south of the equator. The nearest neighborsare more than 400 miles away, on the Gilbert Islands.

But it is the future of Nauru as an island that is debated by ecologists, engineers, and local legislators. Some say when the phosphate runs out the island will be uninhabitable and the residents will have to move off. They might move in with the citizens of another island, or—by dipping into the country's hefty bank accounts—they could easily buy another island for themselves.

Other observers claim that once the droppings are gone, a beautiful tropical paradise—a tourist's dream—could be built on the desolated island. Again, the expense would be relatively minor for the government's substantial wealth.

Currently 1988

There are 14 hams licensed on Nauru, and all have calls with a 2-letter suffix of their own initials—except John Bill, who cornered the enviable *AA*, and Robert Detudamo, who wangled the desirable *DX*. There's also a club station, *C21NI*–the suffix standing, of course, for Nauru Island.

The QSL card from *C21FS*, Frank Smith, calls Nauru the "Pleasant Island." That was the name given by British Captain J. Fearn in 1798, when his whaling ship was the first European vessel to visit the island. In 1886 Germany annexed the island but after World War I, it became a League of Nations mandate administered by Australia. During World War II, Japanese occupied the island and sent 1,200 Nauruians to slave labor on Truk. In 1947, Nauru was made a United Nations Trust Territory. Finally, in 1968, Nauru gained its independence.

A few years ago I sailed to various Micronesian ports aboard one of the Nauruian cargo ships, the *Enna G*. Of the 80 man crew, only a few were from Nauru. Shipboard work—any kind of work—interests few Nauruians. Most were simply seeking paid visits to other islands. Working their way up the ranks of their country's merchant marine was clearly not their goal.

Rarely did the ship make her home port. Mostly she carried hardware to Ponape, cars to Truk, staples to Saipan, and other cargo elsewhere. But for more than a year now, the ship has been semi-laid-up in Majuro, a skeleton crew keeping her barely operational while her future as an investment is debated—slowly—by her nation's leaders back on Nauru.

Still, while that ship rusts away, losing money every day, the typical Nauruian citizen continues to fish, swim, loaf, and tame those frigate birds, apparently worrying not a moment about his or her projected future as a millionaire.

AERIAL VIEW

Antenna News

Arliss Thompson W7XU
7314 SW 28th Ave.
Portland OR 97219

What Is SWR?

This month's column delves into the mysteries of SWR with as little math as possible. But first . . .

A Few Definitions

Let's define our terms. I'll be using the terms "power" and "energy" somewhat interchangeably, as many hams do, although strictly speaking they are not the same. For our purposes, the "line input power" means the power that is actually delivered into the transmission line by a transmitter. "Reflected power" is the power that is (you guessed it) reflected back towards the source whenever an impedance mismatch is encountered. Reflected power is real power, but more on that later. We calculate the percent of power that is reflected by using the formula:

$$\%\ \text{power reflected} = (SWR - 1)/(SWR + 1)^2$$

"Forward power" is the sum of the line input power and reflected power. Lastly, we can define the SWR of a resistive system to be:

$SWR = R/Z_0$ or $= Z_0/R$ (whichever is greater),

where R is the load resistance and Z_0 is the characteristic impedance of the transmission line. There are also formulas to calculate the SWR in the presence of reactance, but I'll leave those for some other time.

Some Examples

The figure shows a typical station setup, with a 100-watt transceiver designed to work into a 50Ω system, a directional wattmeter (wattmeter A), an antenna tuner, a 50Ω coax feedline, and an antenna. An atypical item is that for the time being we'll assume that the transmission line has no losses. I have also added a second directional wattmeter (wattmeter B) in the transmission line between the antenna tuner and the antenna, since readings from it will help to explain what's occurring in this system when we transmit. We also need to specify that our antenna is a perfect 50Ω resistive load on the frequency we will be using.

What happens when we key the transmitter? Since we don't know the antenna tuner settings, we can't predict what will initially occur, but by adjusting the antenna tuner we should be able to get wattmeter A to show 100 watts of forward power and 0 watts of reflected power. What will wattmeter B read? It will also show 100 watts of forward power and 0 watts of reflected power since there is no mismatch at the junction of the feedline and the antenna; i.e., they are both 50Ω.

What would happen if we replaced that 50Ω antenna with one that had a resistive (no reactance) impedance of 100Ω? Key the transmitter and adjust the antenna tuner. What do you read on the wattmeters? If you have properly adjusted the tuner, wattmeter A should read 100 watts forward and 0 watts reflected. Wattmeter B will now show some reflected power, however, because there is no longer a perfect match where the feedline and the antenna join. In a moment we will calculate just how much reflected power would be present. But first, take a look at the forward power indicated on wattmeter B—it's reading 112.5 watts! How can there be 112.5 watts of forward power when wattmeter A tells us that the transmitter is only putting out 100 watts?

What's Going on Here?

In order to answer this question, let's first go back and calculate how much reflected power would be present in this situation. Imagine that the transceiver has just been keyed, and we are following that initial pulse of energy as it travels down the feedline. All goes well as the pulse flies down the transmission line until it encounters the antenna. Now, however, instead of seeing a 50Ω feedline, it is faced with a 100Ω antenna. Whenever electromagnetic energy encounters an impedance mismatch, a portion of that energy is reflected. That principle explains how you can see yourself in a mirror—the air and silvered glass present widely different impedances to the transmission of light and so much of the light that strikes the mirror is reflected.

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$$\% \text{ power reflected} = ((2-1)/(2+1))^2 = 11.1\%$$

$$11.1\% \times (100 \text{ watts}) = 11.1 \text{ watts.}$$

Therefore, the antenna will absorb 88.9 watts (100 - 11.1), and the reflected power will be returned toward the transmitter. But then what happens?

Before the reflected wave can reach the transceiver, it encounters the antenna tuner. Since we adjusted the antenna tuner to eliminate any reflected power between the transmitter and the tuner itself, we automatically created a situation where all of the reflected power would be re-reflected, and once again be heading toward the antenna. Also, due to associated phase changes that occur with reflection, the reflected voltage and current that make up the reflected wave are in-phase with the power coming from the transmitter.

Therefore, as we once again pass by wattmeter B, its forward power meter will read the original 100 watts plus the 11.1 watts of now twice reflected power. When we arrive at the antenna, 88.9% of the arriving power is radiated by the antenna, just as before, but now it's 88.9% of 111.1 watts, or 98.8 watts total. Since our transmitter is only emitting 100 watts, that leaves 1.2 watts to be once again reflected toward the transmitter and the antenna tuner. That 1.2 watts combines with the 11.1 watts present from the first reflection to yield 12.3 watts of reflected power. Then it's the same story all over again: the 12.3 watts is re-reflected at the antenna tuner and combines with the 100 watts being emitted by the transceiver. The forward power meter of wattmeter B edges up to 112.3 watts, while the reflected meter reads 12.3.

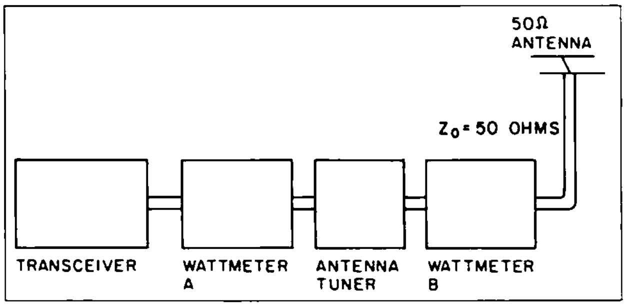

Fig. 1. Test set-up for checking forward and reflected power when the antenna impedance matches the impedance of the transmission line.

This cycle of reflection and re-reflection continues (at nearly the speed of light) until (and this is very important) all of the 100 watts emitted by the transceiver is radiated by the antenna. At that point wattmeter B will be indicating 112.5 watts of forward power and 12.5 watts of reflected power. All of the power "lost" due to reflections at the antenna is regained at the antenna tuner when the reflected power combines in-phase with the forward power. This is true whether the SWR is 2:1 or 20:1. The presence of a large

ed in dirt theory, you don't know quite what to make of the situation, but when the boss comes around and chews you out for not getting as much dirt into the antenna pit as you normally do, you start working harder and decide to do some studying when you get home.

The next morning you show up for work armed not only with a shovel but also with a "pit tuner." The pit tuner is a special device that catches the dirt that the gremlin is throwing back onto your pile and diverts it onto the conveyor belt (feedline). Last night you had read how some people in this situation had gone to the bother of erecting the pit tuner out near the pit itself, but you correctly reason that it would be handier to have the pit tuner near your working position so you could readjust the tuner if need be.

With the tuner in place, you start shoveling at the same pace you've become accustomed to over the years. You can't even see the gremlin with the pit tuner blocking your view, but so long as the tuner is functioning you know that all the dirt you place on the feedline is making it to the antenna pit. True, that gremlin is out there taking dirt off of the conveyor or belt and carrying it back to the pit tuner, but it doesn't matter anymore because when the whistle blows at the end of the day all of the dirt you've been shoveling ends up in the antenna pit.

You might even impress your boss if he looks only at how much dirt is on the conveyor belt, since he will see not only the dirt that you've been putting on the belt, but also the gremlin's dirt that the pit tuner diverts back onto the belt. If your boss was as clever as you, he would know to subtract out the gremlin's reflected dirt when trying to estimate how hard you were working, but having never read about dirt theory, he can only marvel at the amount of dirt on the feedline/conveyor and wonder why the pit isn't receiving any more dirt than normal.

Months go by. By this time you have become quite comfortable with the gremlin because you know that he really isn't doing you any harm so long as you keep the tuner in place. Then one day the boss drops by and complains because not enough dirt is falling into the antenna pit. You're puzzled by this because you know that you have been working as hard as ever. Taking a peek around the pit tuner, you see that the feedline has become worn and dirt is falling out onto the ground, never reaching the antenna pit. As if that were not bad enough, you also notice that the gremlin is spilling dirt onto the ground also. Of course, the more reflected dirt that the gremlin handles, the more that is lost. It quickly becomes apparent to you that the gremlin is now a more serious nuisance than he once was, because now you'll have to start working harder if you're going to keep the standard amount of dirt flowing into the antenna pit.

A similar situation exists in the radio world when you use a lossy feedline; a large component of reflected power can cause considerable heating of the line. Under those circumstances SWR becomes more important, because it may increase losses to an unacceptable level. So what are your options?

Option one is to live with it. Sure, the extra losses due to the gremlin being there may mean a cut in pay, but you earn more than you need, so who cares? Option two is to work harder, increasing line input power, making up for any losses due to dirt slipping through the cracks. Option three is to use a higher quality feedline so that less dirt is lost. Option four is to decrease your losses by moving your operation closer to the antenna pit, thereby shortening the length of the feedline. Option five is to get rid of the gremlin, or at least slow him down, so not so much dirt is lost due to his presence. The analogous solutions in radio are obvious.

So, is reflected power real? Of course it is! If it wasn't you wouldn't be able to see yourself in a mirror. Reflected power meters wouldn't function if reflected power was not real—it takes power to make that needle move on your wattmeter. An open-circuited transmission line represents a mismatch if ever there was one. When power is applied to such a feedline there is 100% reflection of the power reaching the open end. Why should we believe that the outgoing power is real but the reflected power isn't? The answer is that we shouldn't, because the reflected power is every bit as real as the forward power. If all this is unfamilar to you, or if you are simply looking for a review of the subject, I refer you to the excellent series of articles, entitled "Another Look at Reflections," authored by M. Walter Maxwell (beginning in April 1973 QST, p.35). ■

TECH TALK from ICOM

ICOM

The Challenge of Low Frequency DX'ing

Low frequency DX'ing is an increasingly popular interest among today's radio amateurs, and with good reason. The challenge and excitement of working the world on 160 or 80 meters reflects an admirable blend of skillful operating technique, outstanding antenna installation, and superb equipment performance. Each of these areas must be top-notch and work in tandem, especially when operating near the AM broadcast band range of 160 meters. Deficiencies in one area place a high compensating responsibility on another area. Yet with a good understanding of gray line DX'ing, a quarter-wave sloper or quarter-wave vertical and a transceiver with separate transmit/receive antenna connections, adjustable noise blanker, and variable selectivity, working 100-plus countries on low frequencies is a thrill beyond comparison.

The prime times for low frequency DX'ing typically coincide with daily ionospheric changes, or when one end of a path is near dusk/dawn and the other end is experiencing cool evening propagation. As the leading edge of those brief openings are influenced by the sun's early/final daily rays **distant signals rise above a band's noise level and intercontinental communications are optimum.** Advantageously using that phenomenon is often described by serious DX'ers as being on the right frequency at the right time. Improving the odds in that game of chance includes following DX bulletins plus exchanging notes with other DX'ers. Transceivers with fully tunable and independently reprogrammable memories are also extremely beneficial for these times-conscious activities. You can tune a particular range, snap a received station into one memory, select another memory, and continue the search while awaiting your opportunity to contact the previous station. **A "DX window"** and split frequency operating concept is often utilized on 160 meters. By Gentleman's Agreement, non-U.S. stations transmit without QRM in the range of 1825 to 1830KHz while listening on a separately announced receiving frequency. Dual VFOs are thus highly desirable.

Popular antennas for serious low frequency DX'ing are slopers and shunt-fed towers for transmitting, and long wire beverages for receiving. The sloper consists of a quarter-wavelength of wire connected to a coax feedline's center conductor with the coax shield usually connected to the station's tower. When space is limited, the sloper is used for both transmitting and receiving. Shunt-feeding a beam antenna's tower involves installing a long gamma-matching rod and feedpoint tuning unit. A network of 12 to 120 quarter-wave radials creates a vital and very effective ground system, and heavy copper strapping is used for interconnecting indoor/outdoor station items. The high noise susceptibility of vertical receiving antennas is sidestepped by using a one to four wavelength-long wire erected at a constant height of two to ten feet above ground, and terminated with a 500Ω carbon resistor. A 1:9 ratio matching transformer is utilized at the (opposite) feed point end for matching this receiving antenna to 50Ω coax.

Understanding the previously discussed criteria, a **rear panel socket is included on ICOM HF transceivers for bypassing T/R switching circuits and connecting a separate antenna directly to the receiver's input.** Transmitting and receiving antennas should be positioned for minimum cross-induction, and a "front-end protection" circuit should be included near the receiver's input socket.

A suggested protection circuit is shown in Figure 1. The silicon diodes are type 1N914 or equivalent, and serve as a basic limiter to clamp high RF energy levels at the receiver's input. The pilot lamp is a low-current type (number 47 or similar) and acts as a fuse to avoid high induction current damage. The overall circuit encourages confident and smooth low frequency DX'ing.

While older style transceivers might initially seem fine for low frequency DX'ing, such is not necessarily the case. Passband tuning, IF level notch, and a continuously adjustable noise blanker, for example, are vitally important for combatting the unique types of low-band interference. A panel-selectable receiving preamp for beverage use and balanced RF/mixer circuit designs also support high sensitivity, wide dynamic range, and low noise floors. **ICOM's industry-leading designs in these areas are a world-recognized standard of reference.**

The classic amateur radio proverb, "If you can't hear them, you can't work them," is especially true in low frequency DX'ing, and the cornerstone to that success is operating flexibility with superb performance equipment. ICOM's innovative HF transceivers stand proud in this area with professional performance, superb reliability, and incomparable customer support. You're free to chase the "rare ones" with maximum confidence. Ready to experience the challenge and excitement of low frequency DX'ing in top style? Tune in with ICOM and enjoy DX'ing with a winning edge!

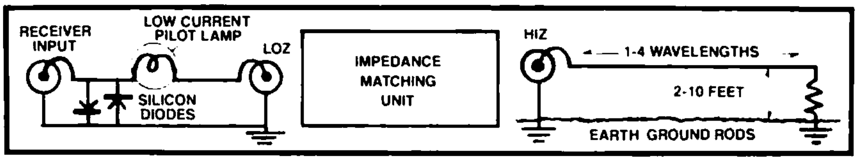

FIG. 1: Front end protection circuit and beverage receiving antenna for low frequency DX'ing.

73 INTERNATIONAL

Edited by Richard Phenix

LU8BF/OA4QC (right) with Jorge Taboada and Armando Garcia.

NOTES FROM FN42

Happy New Year, China! (Year of the Dragon begins on February 17th); its Lantern Festival is on the 3rd. New Zealand celebrates Watangi Day on the 6th; there are four Independence Days in February: 4th—Sri Lanka, 7th—Grenada, 18th—Gambia, and 27th—Dominican Republic. It is Constitution Anniversary in Mexico on the 5th. Other dates to remark upon in DX contacts, 8—Revolution Day, Iraq; 11—National Holiday, Iran, Founding of the Nation, Japan, Youth Day, Cameroon; in the U.S. on the 12th, 14th, and 15th are Lincoln's Birthday, Valentines's Day, and Washington's Birthday; 18th—Democracy Day, Nepal; 23—National Day, Guyana; 25—National Holiday, Kuwait, Victory Day, Czechoslovakia; and the 28th is Kalevala Day in Finland.

ROUNDUP

Response to the idea of developing a Universal Application form for requesting operating permits has been enthusiastic. The first responses, from ZL2VR, SMØCOP, PY1APS, VK9NL, and 4X1MK, among others, will be reported next month. Meanwhile, see box for special information required by some countries—more of these each month in 1988.

The EEC (European Economic Community) has undertaken a project called Eurotra, developing a PC that will simultaneously translate documents into the organization's nine official languages—providing the documents stick to the 20,000 terms programmed. (*El Pais*, Madrid, quoted in *World Press Review*.) *Wouldn't that be a handy gadget for CQ DX calls to India, if it could be converted to cover listeners who might be speakers of any of that country's 16 major languages!* It should save money. According to *The Economist*, London, translations and interpretations in the EEC use up a third of the annual budget of two billion dollars. Some 800,000 pages get translated at a cost of $500 per page. Money saved would be available to other EEC projects such as "Framework," a program "to weld the brainpower of the Community's 12 nations into a single force to take on the US and Japan in every department of industry" including the communications fields. Planners for the future of information technology and telecommunications will have to keep an eye on EEC activities!

Argentina (via Peru): Along with his re-subscription to *73* ("I believe I can take a chance with your fine magazine again, Wayne!"), Dr. L.M. Moreno Quintana (h) LU8BF/OA4QC (see photo), Consulado General de la Republica Argentina, writing from his Embassy in Lima, Peru, brings us up to date on his activity as Argentina's delegate to the 1st to the 5th Conferences Interamericana of Telecommunications. In the 3rd, with Silent Key PY1AX, Mario Romero (Peru), and Pollini (Chile), the idea of the "Lima Convention" was born. In the 5th, with the help of Gustavo OA4AJ, longtime secretary of the IARU, the Lima Convention was approved. Now, if you are an American ham and you have a valid American license (no matter whether or not an American country was your birthplace), you can apply for the same kind of license in another American country. This means there is no longer need for reciprocal licenses between American countries.

LU8BF also writes, "I was also in Nairobi, Kenya, in 1982 at the Plenipotenciaries Conference of the International Communications Union. I operated several times 5T4ITU, put by the Radio Society of Kenya at the disposal of

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SPECIAL INFORMATION REQUIRED WITH SOME PERMIT APPLICATIONS

If you use the proposed Universal Application form printed last month (page 78), add the following special information required for these countries and locations.

France, Guadeloupe, Martinique, St. Martin, Mayotte, St. Pierre et Miquelon, Reunion, French Guiana: These have reciprocal agreements with Canada and the US. Send three copies of request *registered airmail at least 60 days before arrival in France—earlier for the overseas locations* to **CGRP, BP 75, 94002 Creteil Cedex, France.** Send an international money order for 70 French Francs (for a 3-month permit) made out to **Chef de Centre de Compatibilite des Telecommunications de Reseaux Exterieurs (Postal no. 9041 99 F., Paris, France)** Enclose with your application a photocopy of the money order receipt. In addition to the information of the Universal form, give (1) Names of father and mother, (2) List your residential addresses for the last 10 years, (3) List "professions exercised" over the last ten years, and (4) Send photocopies of both operator certificate and station license.

Portugal: Under reciprocity rules the permit will be for 30 days, renewable for another 30 days. The fee is US$20 and should be sent to **Rep-Rede dos Emissores Portugueses, Rua D Pedro, V, 7-4, 1200 Lisboa, Portugal.** Special info: send father's and mother's names and state your profession. Your permit (license) must be picked up personally at the **CTT (Correos, Telephone and Telegraph) office in downtown Funchal, Rua Conde Redondo, 79, 1189 Lisboa Codex.** The ARRL says hams have had success going to that second address personally, doing the paperwork, paying the fee, and returning the next day for the license.

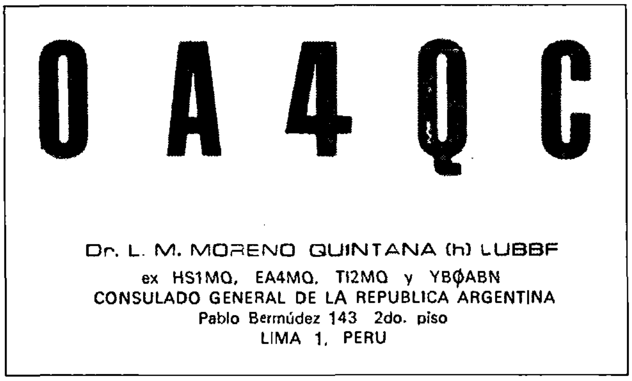
Spain, Islas Baleares, Islas Canarias, Ceuta o Melilla: Write the **Ministerio de Transportes y Comunicaciones, Direccion General de Correos, Subdireccion General de Telecomunicacion, Seccion de Contratacion y Autorizaciones, Plaza de Cibeles, Madrid 14, Spain,** with a self-addressed envelope, at least 3 months before your planned arrival, with a postal order for Pesetas 1600 made out to **Jefe de los Servicios de Telecomunicaciones de Madrid,** *on which you must write your callsign*. If you are going to use an EA's QTH, give his(her) callsign and indicate that individual's willingness to have you do so. Specify that you are requesting a temporary license (which is good for one year).

DOWN UNDER DX GUIDE

The Australian Radio DX Club offers an excellent publication for new DXers, *An Introduction to Amateur Radio DXing*. The 24-page guide covers every major topic that new hams and shortwave listeners (SWLs) may find confusing about DXing on the ham bands. The booklet discusses various communications modes, operating techniques, nets, logs, QSLing, and awards. It also recommends sources for other information on DXing both in and outside of Australia. The guide is available for 10 IRCs (International Reply Coupons), which includes the cost of airmail postage to the US.

The Australian Radio DX Club features a number of useful membership services, including SWL books, reporting guides in French, Spanish, and Indonesian, log sheets, and band charts. Anyone interested in Down Under DXing should contact the club at 60 Richardson Road, Croydon, Victoria, 3136 Australia.

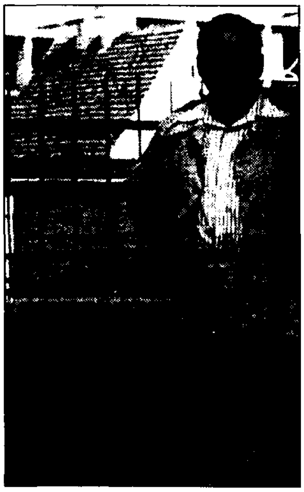
G'day and good DXing!—NA5E



the delegates with valid ham licenses...I [have been] working on a long book since the 1960s about the history of radio amateurs. It is almost finished."

Belgium. From May, 1987, to the end of November 1988, ON4RIP (Rest in Peace) will be on the air, operated by hams from Radioclub Ypres and also from elsewhere in Belgium, France, Germany, and the U.S. The occasion: commemoration of the more than 600,000 who died 70 years ago in the 3rd battle in the Ypres Salient Fields. A special award, the Requiem Award, will be issued for a contact with ON4RIP (SWLs eligible). Send 10 IRCs, US$7, 5 British pounds, 300 BF, 15 FL, 15 DM, 15 SFR, or 10,000 Lira to Ieperse Radioclub v.z.w., PO Box 32, 8900 Ieper, Belgium.

Brazil. PY1APS writes: In April 1981, Joao Havro PY5AVR made a CQ DX call which was answered by Edmund Gorecki SP2WI from Gdynia, Poland. Joao was delighted to have the chance to ask if there were Havros still in Gdynia—his grandfather, Luis, had moved from there to Brazil but left behind a brother, Joseph, with whom he had lost touch. A week later SP2WI was able to report that there was a Henrik Havro there; he turned out to be Joseph's son—and a few months later Joao visited Gdynia and his relatives there; he had an eyeball QSO with Edmund Gorecki, who gave him a tour of the city. PY5AVR visited again this summer and was distressed to find his ham friend SP2WI seriously ill and in financial straits with medical expenses. Hams helping hams: Joao has asked his friends in many CW Brazilian Groups and elsewhere for contributions to help SP2WI, at UL Kastelanska, 1; 81412 Gdynia, Poland.



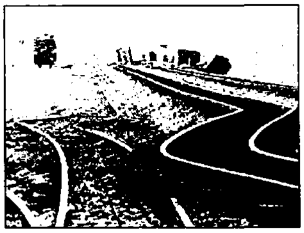
Edmund Gorecki SP2WI. (Photo by PY5AVR)

Israel. April 9, 0001–2400 UTC, Single op, SSB and CW, worldwide, Israel ARC 40th Anniversary contest on 1.8, 3.5, 7, 14, 21, 28 MHz (30 kHz from bottom of band recommended for CW). Purpose: to contact as many Israeli amateur stations with different prefixes and locations as possible. Details in the March column *if space is available! Don't count on it!*

Korea, Republic of. HL5AP sends New Year's greetings:

IARU's Region 3 Seventh General Convention will be held in conjunction with the 1988 Olympics, beginning with a Board of Director's meeting on Saturday October 8. Park Sung Bang HL1AFR, vice president of KARL, will be chairman. Opening ceremonies will be at 0930 on Monday, the 10th. That evening will be the ROK Minister of Communications' dinner. Conference sessions end Friday, the Board meets again that afternoon, the KARL dinner is that evening, and IARU Administrative Committee meetings will occupy the weekend.

New Zealand. The September, 1987, issue of *73* had the Bay of Plenty earthquake story; here is a picture. Ordinarily we would not use it since we had to reproduce it from a magazine page and that (all contributors please note!) can rarely be done satisfactorily for technical reasons. In this case, just the twisted lines tell the story. (Thanks to ZL2VR, and to *Crusader* magazine for May/June 1987.)



Sweden. SSA (Sveriges Sandareamatorer) announces two new awards, starting date January 1, 1988: W/H/ASA (Worked/Heard All Sweden) and SLA (Swedish Locator). (See Figs. 1 and 2.) The general rules are the same for both: All contacts to be made from the same QTH or within a radius of 150 km (90 miles); each contact must be on the same band and mode, but different contacts valid for other modes and bands: stickers issued for 2xCW, 2xPhone, 2xSSB, and 2xRTTY; valid as different bands are HF 1.8, 3.5, 7, 10, 14, 18, 21, 24, and 28 MHz, with separate awards for 144, 432, and 1296 MHz and Satellite. Earth repeater contacts not valid. Applicants must be members of an IARU-associated amateur radio organization. Confirmation with QSL cards or equivalent required plus a list of them in alphanumerical order. Applicants outside Sweden may have QSL cards checked by the Award Manager of the domestic national amateur radio organization and submit only a confirmed GCR list of the cards. Send to The Award Manager, SSA, Ostmarksgatan 43, S-123 42 Farsta, Sweden. WASA fee for each award: 30 Swedish kroner, US$5, or 10 IRCs.

SLA: Available to SWLs also; locators according to the new Maidenhead World Locator System (324 Fields, each having 100 locator squares—designations consist of two letters and two numbers, like JO89, which is SMØ COP's locator). The basic award is for 25 Swedish locators; stickers issued for 35, 45, 55, 60, and all 64. Award fee: 30 kroner, US$5, or 10 IRCs; stickers are 5 kroner, US$1, or 2 IRCs each. Mail as above.

Continued on page 99

Call Area	Laen	Code for laen
1	Gotland Island	I
2	Norrbotten	BD
	Vasterbotten	AC
3	Jamtland	Z
	Vasternorrland	Y
	Gavleborg	X
4	Kopparberg	W
	Orebro	T
	Varmland	S
5	Vastmanland	U
	Ostergotland	E
	Sodermanland	D
	Uppsala	C
6	Skaraborg	R
	Alvsborg	P
	Boteborg and Bohus	O
	Halland	N
7	Malmohus	M
	Kristianstad	L
	Blekinge	K
	Kalmar	H
	Kronoberg	G
	Jonkoping	F
0, 5	Stockholms laen	B
	Stockholm City	A

Fig. 1.

Class	Europeans	Non-Europeans
3	All Swedish laens on two different bands	All eight call areas
2	All laens on three different bands	All laens
1	All laens on four different bands	All laens on two different bands
Plaque	All laens on five different bands	All laens on five different bands

Fig. 2. Requirements for WASA.

73 INTERNATIONAL

from page 96

BRAZIL

Carlos Vianna Carneiro PY1CC
Afonso Pena, 49/701
20270-Rio de Janeiro
Brazil

[The following information about the Abrolhos Archipelago "for, I hope, the January issue," was doomed to appear no earlier than this month even before it was mailed, on November 16. Yes, it frustrates us, too, but a basic deadline requires receipt of material on the first of a month for the issue dated two months away—the first of November for the January issue. (Brief, important, news sometimes can still make it if received two weeks late.) Since PY1CC's Fernando de Noronha's article had to be held until this issue, we are giving just bare-bones facts from his just-received article and are asking him instead to give us an after-the-event report later—Ed.]

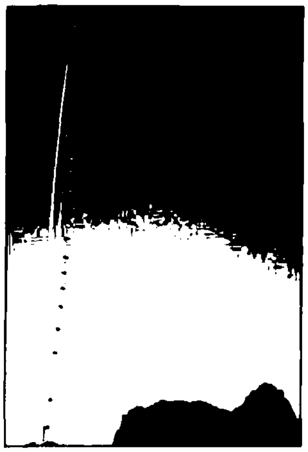
DXpeditions to Abrolhos Archipelago (SA-19 in the Islands-On-The-Air—the IOTA—Directory of Islands) are so rare I don't even remember the last time amateurs operated from there. Now Donald Cutrin PY1WO is taking a group there early in January to stay until the 24th, and also taking an electronics technician, Carl PY1CC. The call will almost surely have the 6EMM suffix with special prefix. On CW, the 020 frequencies will be tried, with up or down split frequencies if pileups occur. SSB mode as usual, 3.800, 7.080, 14.195, 21.195, and 28.510 kHz, with split operation, 5 up or down. So IOTA Awards hunters and World Prefix hunters be alert! QSL manager, PY1EMM, Avenue Brasil 9020, CEP 21030, Rio de Janeiro, R.J., Brazil.

• • • • •

FERNANDO DE NORONHA

Steve NN7X/PY1ZBH mixed fun with pleasure by operating with the special callsign ZY0ZZB while on holiday in Fernando de Noronha ((PY0F) from July 1 to 10.

Peter VE3PHH was to have



The homemade G5RV multiband antenna and telescoping pole extended to 10 meters.

gone with Steve but had to cancel out for business reasons—a pity because Peter would have brought another rig and antenna from Canada. Steve, operating on all bands and only a few hours each day, made 1,521 CW and SSB contacts and worked 112 DXCC countries. The island's many attractions were such that he spent more time on the beaches and in general sightseeing than operating.

F.N., a tiny archipelago belonging to Brazil, is only 4 degrees south of the equator in the South Atlantic, some 450 km off Brazil's northeast coast. Perhaps because of this close proximity to the equator, propagation was decidedly weird. In the mornings and early afternoon it was essentially one-way. Steve could hear many stations but could not work them, nor were his many CQs answered. Later in the afternoon, good signal reports were generally obtained from Europe, Africa, and the Americas, and pileups occurred.

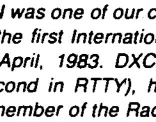
Interestingly, there was absolutely no propagation to the Pacific, East and South Asia, and Oceania on any band at any time. There was very little to W6- and W7lands and Western Canada. Also, there was never any propagation on 160 meters although Steve had 160 capability and tried repeatedly.

His rig was an ICOM 735 running 50 to 100 Watts, a Hy-Gain 14AVQ vertical supplied by Hank

ZY0ZZB and the 14AVQ vertical on Fernando de Noronha.

N6HJ, and a G5RV multiband wire antenna which Steve made up in Rio de Janeiro just before going to the island. There are no trees or other supports available, so the G5RV was put into an inverted-vee configuration hoisted on a homemade aluminum pole telescoped to a 10-meter center height.

Steve said the success of his operation was due to the outstanding assistance of the Brazilian amateur radio community, and gave special thanks to Armando PY1ECL, Ron PY1BVY, and Vasco PY0FG.



CHILE

Patricio Fernandez H. CE3GN
Casilla 14781
Santiago
Chile

[CE3GN was one of our contributors to the first International section in April, 1983. DXCC twice (the second in RTTY), he is an active member of the Radio Club de Chile, surely one of the first to be formed (in 1922).—Ed.]

I would like to draw your attention to the ever-increasing problem of interference by nonlicensed stations. Being an avid DX chaser, most of my radio operation time is devoted to listening in between 14.070 and 14.100. It is not rare to find amateur phone stations in this segment of the 20-meter band who, by ignorance and/or plain convenience, carry out conversations, possibly thinking that it is an excellent hideout or that nobody is listening to them. All the stations I have heard have been Latin American, and in most cases just a few convincing words of warning have been sufficient for them to QSY to above 14.100.

This type of interference is not the real problem, however. The real and incredible interference situation is carried out by non-amateur, nonlicensed, totally pirate stations that are operating on this segment of the band. Throughout the past 12 months I have been patiently monitoring a couple of stations that appear daily at around 14.091 on USB phone. The language is Spanish, and by their accent I am positive they are not CE, LU, or OA. As the transmission comes from the north, and considering propagation and time, I have no doubt they must be situated around HK- or YVland, with a slight chance of being HC or CP.

I have monitored the same stations (same voices) almost every day at around 2300Z to 0200Z. Earlier than that I am at work, so no monitoring by me has been made at other times when they might also be active. Their topics of conversation are strictly commercial and very obscure. I would not be surprised at all if it were related to narcotraffic. Every time I have attempted to chase them away, they have answered back with extremely obscene language and have ignored my warnings. The few times I have been successful in making them QSY—with some convincing bursts of RYRYRY from my RTTY transmission—they have limited their shift to a few kHz up or down and have continued their illegal operation. They have never given a callsign of any sort, and their usual calling procedure is by a certain type of whistling on the microphone.

The reason for telling you of my experience is that I am convinced many of you who usually operate RTTY on 20 meters have heard this illegal activity, and if we exchange information we may rapidly be able to locate these stations—or at least find out more about them. In that event we could inform the local authorities of the country(ies) involved so that they could do something about the situation.

If any of you readers feel you have information please let me know as soon as possible so that I may coordinate some action and, hopefully, get rid of these disgusting intruders.

Number 39 on your Feedback card

Op-Ed

by Larry Ledlow, Jr. NA5E

A Brief Look Ahead

A reader called me the other day to say how glad he was "to see *73* had finally entered the 1980s." Editors always like to hear good things about their magazines, and I am no different. There's something special about a stroke of the ego. Constructive criticism serves a good purpose, but a compliment always seems to make worthwhile the long hours and sheer madness in the rush towards deadline.

73 has entered the 1980s, all right, and we're headed for the next decade—nay, the next century—PDQ! It's one thing to be up to date, but it's quite another to look ahead, to set goals, to plan, and finally to take steps toward those goals. My motto for the magazine: Communications techniques and technology for today *and* tomorrow.

Taking a look at feedback cards and talking to subscribers at the hamfests, it's very easy to conclude the majority of our readers are insightful, technology-oriented, and like to keep informed. Newcomers to the hobby pick up *73* because of our friendly approach. No doubt about it, readers turn to *73* as a modern, practical and useful information source. They've grown tired of silent key lists, DXCC certification debates, and endless contest announcements.

We're picking up momentum, moving ahead like no other ham magazine can, because the readers want it that way. We'll take you to the future. We're excited about the future. Let's take a brief look at just a few things that will happen in the next several years.

WARC 1991

Wonderful days lie ahead. Before long we can all bask in the warmth of increased sunspot numbers and better propagation. Just think, 20 meters will be open 24 hours a day, and a light breath on the mike will snag a contact. Great! Take advantage of it while you can, because the next sunspot cycle peak may come along when ham radio is all but dead on HF . . . unless we start planning right now.

I'm pretty optimistic and upbeat about the future of ham radio. At the same time, let's take a look at some major forces that threaten the HF ham bands.

International shortwave broadcasting is *big* business. Just scan across 6, 9, 11, or 15 MHz some day with that general coverage capability built into your transceiver. Wall to wall signals, right? Whether for God's word, the Communist Manifesto, or Quechua Christmas carols, millions of people the world over listen to international broadcasters, and the number is increasing.

You can bet the broadcasters are aware of improving band conditions. And as more and more broadcasters vie for the same frequency allocations, interference will no doubt increase. The stations received more frequencies at the last World Administrative Radio Conference (WARC) in the late 1970s, but the increase failed to satisfy today's incredible demands on HF band space.

The pressure on frequency allocations comes also from increased needs of military and commercial interests. All three HF user groups are well organized. Guess where they're going to look for more frequencies at the next WARC? You got it, the ham bands. Hams occupy some pretty favorable frequencies, like 20 and 15 meters, and unless we get organized and plan ahead, we may see a reduction in our frequency allocations!

The next WARC, probably to be held in 1991, is practically around the corner. Don't kid yourself. The broadcasters are already planning!

Upward Bound

AMSAT's Phase IV satellite in geosynchronous orbit is something else to look forward to in the early 1990s. The satellite will orbit above the same point on Earth, more than 22,000 miles above the equator, just like today's commercial communications satellites. The convenience of a geosynchronous hamsat will hopefully turn on a lot of folks to space communications. A repeater in the sky, I guess you could call it. No need to schedule QSOs around two or three 15 minute orbit "windows" each day as with low orbiters.

Increased communications activities from the Space Shuttle and the Space Station are also pending. More hams will turn their antennas skyward to converse with astronauts.

Think about it! It's just a few years away. This stuff is getting exciting!

Another Revolution

Digital technology is alive and well in commercial and military worlds. It's just about time for some pretty smart gadgets to enter amateur service. High-speed A/D converters are fairly inexpensive. Some smart signal processing software built into an EPROM could take care of a lot of QRM problems. Digital filters and synchronous signal detection are all affordable and within the realm of modern technology. We hams use some pretty basic communications methods that digital signal processing can handle without any trouble at all.

More important, it's about time we weaned ourselves from antiquated and inefficient (from a band width point of view) communications technologies. I'm glad to see a number of manufacturers—AEA and Kantronics, among others—taking advantage of modern digital techniques.

Digital is the way to go, believe me. Once you have a signal in ones and zeros, the possibilities for processing are endless! You can add, subtract, delete, multiplex, randomize, and invert ones and zeros in a split second with a tiny chip. Amazing advances, when you think about it, and it's just around the corner!

Come Along With Us

C'mon now. I've just given you three things coming up in the next few years to get pretty excited about. If you're not a techie or a space cadet, then you ought to at least get worked up over the possibility of losing frequencies.

73 will be there, keeping you informed. We're looking ahead and making plans. You, the readers, are taking us there with your continued support, dreams, and inspiration. We're looking forward to what will come. Together we will share the excitement of the future.

I'm ready. Are you?

MARCH 1988
ISSUE #330

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03
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Welcome, Newcomers!

Why Just VHF Antennas?

VHF is not just a name for the band of TV channels from 2 to 13. It means Very High Frequency and it applies to that band of frequencies from 30 MHz to 300 MHz. Of course, the frequencies for TV channels 2–13 are contained in this range, as well as many other services. The amateur radio service has three VHF bands, as well as many bands above VHF.

73 Magazine has in the past devoted issues to antennas covering the whole radio frequency spectrum. The subject of antennas has become so broad, however, that we can't begin to do justice to its entirety in a single issue. Therefore, this issue deals with VHF-and-above antennas, and the September issue will deal with antennas for 30 MHz and below.

From Heah to Theah

Why divide the spectrum at 30 MHz? The reason is that propagation characteristics change radically at around 30 MHz. The ionosphere refracts waves below 30 MHz back to Earth, which in turn reflects the waves back to the ionosphere. Waves often travel around the Earth in this vertical zig-zag pattern. It is this kind of propagation—sky wave propagation—which allows us to hear trans-continental short wave stations and distant AM stations at night.

Waves above 30 MHz usually pierce the ionosphere and zip out into the cosmos. Unsuspecting alien societies in different solar systems may hear all about a VHFer's new rig or the latest Star Trek film. Earth-bound VHFers, however, have to hear about it via the tropospheric wave, a wave useful only when there is a direct clear path between the transmitter and receiver. This is the kind of propagation used for television, or between a ham's mobile transmitter and a repeater. Normally, only line-of-sight tropospheric propagation is available to VHF and UHF enthusiasts.

However...

One late spring night I was watching Channel 5 on TV, which normally receives a Boston station located about 80 miles away. All of a sudden I was hearing (though not seeing well) strictly Canadian news. After a few minutes, the TV station identified its location as Ottawa—over 300 miles away! For a brief period, its signal overrode the Boston station located a quarter of the distance away. How could this happen?

We chose this month for VHF-and-above antennas for a very good reason. The spring and summer in the Northern hemisphere, with all its active weather, creates conditions that allow VHF tropo waves to propagate well beyond line-of-sight—sometimes thousands of miles!

The most common DX VHF propagation mode is tropospheric bending and ducting. The Ottawa television station came into southwestern New Hampshire through a tropo duct.

Another useful mode is sporadic E, in which signals are bounced from ionized patches of the ionosphere's E layer. Aurora are disturbances in the Earth's ionosphere and magnetosphere, and they will also support VHF and UHF propagation. When meteors enter the Earth's atmosphere they produce ionized trails of gas that VHF and UHF signals bounce from. Meteor scatter isn't for everyone, but we show you how to do it in this issue. Moonbounce or EME (Earth-Moon-Earth) is an even more exotic way to get distance on VHF. For those who choose to investigate, VHF-and-above offers a lot more than a line-of-sight link to the local repeater.

Go Forth and Propagate

Fascinated with VHF-and-above propagation and antennas? There are many fine sources of information levels on this, several here in *73*. Arliss Thompson's "Aerial View" column for is an excellent monthly antenna tutorial. Pete Putman's "Above and Beyond" column discusses the latest happenings in the world of VHF and above, and is ideal for those beyond the beginner level.

Hope to see you on the higher bands!

...de KA1HY

GLOSSARY

Radio frequency spectrum—The portion of the electromagnetic wave spectrum which covers waves whose wavelengths range from 30 kilometers to 1 millimeter. The corresponding frequencies are 10,000 cycles/second (10 kHz) to 3000 billion cycles/second (3000 GHz).

Propagation—The transfer of energy through a medium, such as the atmosphere, or through space.

Ionosphere—An upper-atmosphere layer, ranging 75–200 miles above the Earth's surface. So called because molecules at that level are ionized (i.e., they lose electrons) by solar radiation.

Sky Wave—A radio wave that travels up to the ionosphere and is refracted back to Earth. A single skip sky wave—one that is refracted just once by the ionosphere can travel up to several thousand miles. They are mainly responsible for world-wide radio communications.

Tropospheric Wave—A wave that travels through the troposphere, the lower part of the atmosphere that extends up to six miles from the Earth's surface.

Repeater—A machine that receives a signal and simultaneously retransmits it on a different frequency. They are normally used to extend the range of line-of-sight signals. They are very popular for mobile-to-mobile VHF-and-above communications.

DX—Means "Long Distance." The distance that qualifies as DX varies from band to band. VHF-and-above DX are distances well beyond the range of line-of-sight.

Tropospheric bending and ducting—The condition where radio waves are refracted when passing between two atmospheric layers in the troposphere that have sharply contrasting temperatures and moisture contents. A duct is formed by a layers of air with different propagation characteristics. Often moist cool air sits over warm dry air, which in turn sits on the Earth. Since the wave is refracted by the moist, cool air layer, and reflected by the Earth, the warm dry air layer acts as the duct, or waveguide. Waves of up to 10,000 MHz have travelled hundreds of miles by ducting. Ducted VHF waves have been detected from several thousand miles away!

Sporadic E—This is propagation whereby sky waves are refracted by dense patches of ions in the E-layer of the ionosphere. Waves up to 430 MHz are known to have been propagated via sporadic E. Since this layer is in the lower ionosphere, wave skip distances are shorter (typically 400–1300 miles). Also known as "short skip."

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73 AMATEUR RADIO

MARCH 1988 Issue # 330

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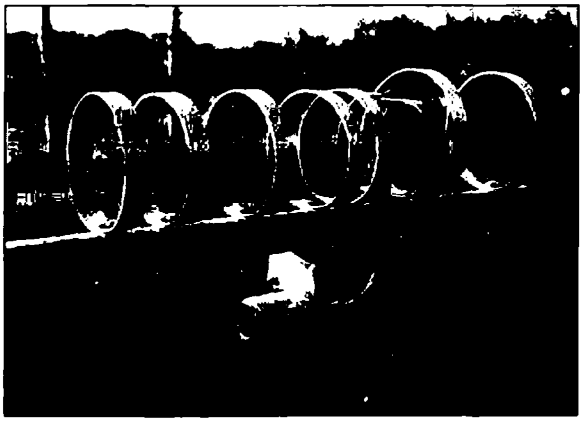
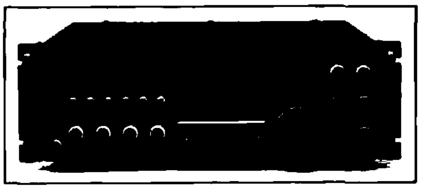


REVIEWS

DEPARTMENTS

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 89. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

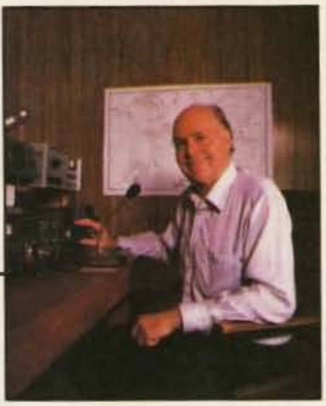


Cover design and illustration by Deborah Smith.

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Running for VP? That's Crazy!

Maybe.

No, of course I don't expect to win. The chances of that are beyond calculation. Heck, if the chances were good, I wouldn't do it. Which vice president said the job was as interesting as a bucket of warm spit?

It's not that I'm tilting at windmills. I hope the platform of running for vice president in the New Hampshire primary will give me an opportunity to get across a message I think is important.

In my editorials I have been railing against the way America has sunk to second in world financial strength. I've been worrying about our loss of consumer electronic industries to Japan. Being a solution-oriented person, I believe I have some worthwhile ideas on ways to get our country back to #1.

As a candidate for national office I have an opportunity to discuss my proposed solutions to America's problems and get them heard. As a result I've been interviewed by papers all around the country—have appeared on a number of radio interview shows—and have been asked to speak to service clubs. The plan is working.

High-Tech Education

I've written in my 73 editorials about some of my ideas on how to get America back to #1. One key area is to improve our educational system, which sure could stand it. Here I have a number of proposals for ways to increase educational productivity. But the most basic concept is to start teaching every child in America the fundamentals of electronics, including communications and computers. This would be supported by a concerted effort to get kids involved with high-tech hobbies such as amateur radio, computers, electronic experimenting and science fair projects. We could use the young hams, that's for sure.

If you've kept up with communications technology, you know that everything is going digital. Even TV is going digital. Business communications today involve much more than telephones. Today's office phone systems are highly complex digital communications systems, with all sorts of features. Indeed, old timers find they have to be retrained on how to use their phones every week or so.

Business communications now include the widespread use of facsimile, copy machines, telephone answering systems, pagers, cellular telephones, business car radio, satellite links, computerized bulletin boards, 800-numbers, Telex, data and communications services such as MCI, Compuserve and The Source.

Both home and businesses are trying to cope with CD, CDI, VDI, DAT, 8mm video, VHS-C, S-VHS, digital VCRs, HDTV and so on. Soon we'll be up to here in superconductivity oriented products, fibre optics and other technologies light years ahead of anything we're seeing in amateur radio. Yet even so, I believe amateur radio is a great medium for getting kids interested in technology, so I'm willing to open myself to the ridicule I know I'll get from the other ham magazines. It's a small price to pay if I can get across my message to the American public.

Business Incentives and More

In addition to revamping our educational system—bringing it into the 20th century and cutting college costs by 70%—I'm also a big fan of changing our tax structure so small businesses will be better able to compete with foreign companies—so we won't have to turn to Asia for cheaper manufacturing in order to be competitive.

Further, I believe we can cut both military and government costs substantially by setting up a whistle-blowing commission. The people in government see the ways money is wasted and would love to blow the whistle—if it could be done without their sacrifice. I've been getting earfulls from hams working for the government.

Continued on page 69

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRM

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QRX . . .

EDITED BY BRYAN HASTINGS KA1HY

Novice Enhancement

This month marks the anniversary of Novice Enhancement. Fred Maia of *W5YI News* sums up below the effect of Novice Enhancement for 1987.

The increase in the total number of ham radio operators is due to expansion at the Novice and Technician level. The total amateur census—the net increase of hams—increased by 9,119 in fiscal year 1987 (10/86 to 10/87). The Novice and Technician ranks swelled by a net 9,157! These figures show the General, Advanced, and Extra-class ranks suffered a net decrease.

12,708 applicants became Novices in the period from April–October 1986. 16,304 applicants became Novices in the same period in 1987. This is a 28.3% increase.

Novice Enhancement is clearly working.

33cm Band Threat

At this time, 902–928 MHz is assigned to all amateurs, except Novice Class, for CW, Voice, SSTV, and FAX. Amateur radio is in considerable danger, however, of losing this band to commercial interests. The FCC has proposed (General Docket 87-389) opening up the band to license-free consumer "broadcasting." Such broadcasting includes remote devices for home appliances, such as TVs, stereos, VCRs, and CD players.

Radio Electronics, a leading electronics magazine, responded quickly to the FCC proposal. Brian Fenton, the Managing Editor, wrote in an editorial in the January 1988 issue, "The electronics industry would benefit tremendously from the new markets opened up. The license-free band could open up new horizons in home automation, eliminating cables between video cameras, stereo speakers, etc. Needless to say, however, there will be many problems to overcome before the band can come into use. Interference from amateur radio and government agencies that currently use the band is only one of them."

It's interesting to note that the proposed new applications are already in trouble because of possible interference from amateur radio!

The amateur radio community must take action to secure 33cm. *73 Magazine* encourages—nay, *exhorts*—readers to respond to this issue. Let us and the FCC hear from you!

Kowalski Resigns

FCC Special Services Division Chief Raymond Kowalski tendered his resignation effective January 3, 1988. Kowalski served the past six years as the overseer of all the Commission's regulatory efforts in the amateur radio service. He left his post to accept a position on the legal staff of the prestigious law firm of Blooston and Morkofski. No successor has yet been named.

Haller Appointment

Ralph A. Haller N4RH is the new Chief of the FCC's Private Radio Bureau (PRB). Haller replaces Robert T.N. Fitch who recently became the Senior Legal Advisor to the Chairman of the FCC.

Haller has become the highest-ranking FCC official who is also an amateur. The Private Radio Bureau answers directly to the FCC Chairman and to the FCC Office of Managing Director. The Special Services Division, the office from which Ray Kowalski just resigned as Chief, answers to the PRB.

Haller worked as chief engineer and announcer for several broadcast stations in Kansas before joining the FCC's staff. He was also a partner with Broadcast Consulting Services, a Topeka engineering firm.

Haller joined the FCC in 1971 as a radio inspector in the Los Angeles District Office. In 1976, he moved to Washington D.C. to accept a position with the FCC's Field Operations Enforcement Bureau. He held several other positions with the Commission until he became deputy chief of the PRB in 1986.

Ralph, an Extra-Class licensee, helped pioneer the implementation of the All-Volunteer Amateur Testing program.

New Phone Patch Rates

Repeater trustees in 4- and 5-land just received good news. Southwestern Bell recently amended their criteria for classifying the type of service charges for phone patch lines. This makes it much easier for a repeater to be classified residential instead of commercial, which cuts service charges in half. These two hindering stipulations to class a repeater residential have been dropped:

•Service cannot be co-located with business service; and
•Service must not be located in an area zoned for commercial only

The following are the only stipulations now to classify a repeater "residential:"

•Amateur use only;
•No advertising;
•No business functions performed; and
•Not located in a public meeting place

Anyone wishing to know about the events leading up to this decision may contact Paul Gilbert KE5ZW, 210-38th St., Snyder TX 79549, (915) 573-2163. This decision sets a very important precedent for repeater classification.

Canada ARS Restructuring

Canadian Amateurs eagerly await the new regulations on the restructuring of the Amateur Radio Service. A Regulatory Impact Analysis Statement will accompany the new rules. If there is little comment, the new amateur rules will go into effect after allowing some months for amateurs and others to adjust to the changes. Canada will likely adopt an entry-level Certificate "B" all-mode "Basic Amateur" license that will not require code.

W7PHO SK

Well-known DXer Bill Bennett W7PHO died at his Seattle home early on Wednesday, December 23rd. Bill was probably best known as the founder and moderator of the W7PHO Family Hour Net.

Still No Instant Novice

The FCC has denied a petition, RM 5924, filed by KJ4JE, which requested that a Novice examinee begin operating immediately by using a temporary callsign consisting of the callsign of one of the volunteer examiners plus a unique numeral. The FCC said that the application processing period is not unreasonable and that the instant licensing proposal appears to be contrary to international radio law.

Thanks!

to the news items contributors this month. They are *Westlink*, *W5YI Report*, *The ARRL Bulletin*, *The Chattering Relay*, and Paul Gilbert KE5ZW. Keep your ham radio-related news, graphics and photos rolling in to: *73 Magazine*, WGE Center, 70 Rt. 202N, Peterborough NH 03458-1194. Attn: QRX.

73 Review

by Pete Putman KT2B

Down East Microwave
Box 2310, RD #1
Troy, ME 04987
Price Class: 3333-LY $93 Assembled/$77 Kit
1345-LY $80 Assembled/$67 Kit

Down East Microwave 3333-LYK 902 MHz and 1345-LYK 2304 MHz Loop Yagis

Great DXing on the higher bands and portable, too.

Looking for a high-gain, light wind-load antenna for microwave operation? Look no further. Down East Microwave, a specialty manufacturer located in Troy, Maine, makes a full line of loop yagis for the frequency range 900-3456 MHz. The antennas use the design pioneered by G3JVL and G8AZM. I procured two of these for permanent installation on the 33 and 13cm bands to go along with newly acquired transverters.

There is no mystery about loop yagi operation. They perform just like ordinary yagis, each with a driven element, reflector and directors. Full-wave elements, instead of conventional half wavelength dipole elements, make these antennas stand out. The antennas exhibit high forward gains and good front to back ratios.

Quality Construction

The 902 MHz yagi consists of 33 elements, while the 2304 MHz version has 45. Both have two reflectors. Photo A shows the elements directly behind the driven element of the 1345LY. Miniature hardline feeds the full wavelength driven element from a female N connector mounted on the boom. Incidentally, slightly flattening the driven element provides the best match to a 50Ω line. The remainder of the parasitic elements are aluminum symmetrical loops fastened to the boom with stainless steel hardware.

The booms are made from extremely rigid 6061-T6 aluminum. The loops are fabricated from ½" width (902) and ¼" width (2304) medium-gauge material that bends with some resistance but holds its shape. Antenna lengths and boom material permit installation on a 1" diameter mast without boom braces.

The yagi kits come shipped in two parts: the boom sections and the element/bracket kit. Complete instructions come with the antennas, including a helpful pictorial diagram. Many of the directors are of the same length and they are prebent and sorted into bags containing identifying numbers. This thought really speeds up assembly. A ¼" nut driver and fingers are the only tools required. Assembly time for each yagi is about one hour. Be careful not to over-tighten the hardware, or the loops will distort.

The flexible hardline comes pre-connected to a type N fitting, but it requires bending to connect to the driven element. The manufacturer suggests soldering the coax first, then gently bending the hardline back at 90 degrees to the element. The connector bracket will then easily attach to the boom.

Down East Microwave supplies stainless steel hardware for all fastenings except the boom-to-mast clamps, which are 1" galvanized U-clamps. The mounting bracket is a piece of aluminum plate stock bent at right angles. It fastens through the boom at the balance point, and a hole has been drilled out to clear the director it lies under. This makes a very secure and rigid support. I mounted the antennas on a homebrew aluminum "trident" frame (Photo B).

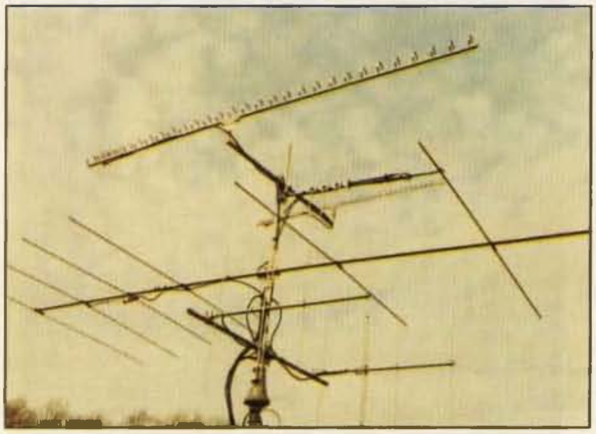


Photo A. Closeup of the 903 MHz feedpoint. Note the two directors behind the slightly flattened driven element. The driven element does not make a complete loop.

Down East Loop Yagi Technical Specifications

Specification	3333-LYK	1345-LYK
Frequency Range	880-910 Mhz	2.2-2.35 Ghz
Number of Elements	33	45
Boom Length	12'	6'9"
Weight	5 lbs	3 lbs
Gain	18.5 dBi approx.	21 dBi approx.
3 dB Beamwidth, E plane	20 degrees	16 degrees
Front/Back ratio	>20 dB	>20 dB

I'm Impressed

Neither antenna required adjustment for matching. At the time of this writing, I only had the 902 MHz loop yagi in service on an SSB Electronics LT-33S transverter. The LMW 2304 transverter was still under test, and I made preliminary 2304 MHz adjustments with an extremely low level RF source. The 902 MHz antenna showed a minimal amount of reflected power using 25 watts and a Bird 50E slug, which indicate the SWR was easily under 1.2:1 without adjustment. After several heavy rainstorms, the beaded water remaining on the loop elements did not have any effect on matching.

I have made contacts with the 902 loop yagi as far away as 50 miles using just 25 watts and easily copied the other station, which only used six watts. The manufacturer claims an E-plane 3 dB bandwidth of 20 degrees, and my on-the-air observations agree.

These light weight, strong, high-gain antennas for 902 and 2304 MHz from Down East Microwave represent good value. They use high quality materials and workmanship to produce quality products. I can recommend them for portable operation, too, since the loops are very rigid and can withstand moderate abuse. For great DXing on the higher bands, try the 3333-LYK or 1345-LYK loop yagis.

Two Meters Aboard the Winnebiko

An Essential Link for Dataspace

by Steven K. Roberts, N4RVE (formerly KA8OVA)

I still remember my first attempt at a bicycle-mobile 2-meter installation: A battered Kenwood HT bungeed onto a handlebar pack with a speaker-mike clipped to my shirt. The antenna was a quarter-wave mag-mount Ty-rapped to the rear rack with a ten-foot coil of excess coax lashed to the frame. When the radio's internal batteries died, well, I was out of communication. A five minute installation job like that, while superficially entertaining, is guaranteed to fall apart under full-time use. There is no such thing as a trivial task where electronics are involved.

But my new bicycle-mobile 2-meter system is considerably more robust. Yaesu's multimode 290 is shock-mounted in the control console, as much a part of the bike as the 48-spoke wheels and 54-speed transmission. The rig is powered by two fully redundant solar-charged 5 amp-hour batteries, and it drives a Larsen half-wave antenna mounted to the seat back. Audio is piped to either the console speaker or an earpiece built into the helmet, and voice input is either a TT-mike plugged into the front panel or a preamplified electret boom mike attached to the earpiece. A push-to-talk button is embedded in the left handlebar grip under my thumb. . .and, as I mentioned in last month's introductory article of this series, the Yaesu is deeply integrated with a number of other onboard systems including touch-tone remote control, bike security, and packet.

Rig Choice and Mounting

When it became clear that the transceiver would be permanently mounted in the bike's control console instead of just stashed in a pack, the choice of unit became critical. I quickly discovered that no HT could do the job, since the physical distribution and poor readability of controls and indicators would make installation awkward. This led me to consider automotive units, such as the attractive new ICOM IC-28.

Photo 1. Closeup of the Winnebiko's "Brain Interface Unit" and the black Larsen Kulrod™ Special antenna. The Bell Tourlite™ helmet houses a Plantronics headset, chosen for its ruggedness and resistance to moisture.

But the problem here is power—rigs made for cars tend to run warm, wasting half an amp or more on standby. Since my on-board battery capacity of 10 amp-hours has to be shared with lights, computers, security, stereo, and dozens of other loads, automotive 2-meter rigs are unacceptable.

Yaesu, however, markets an interesting hybrid unit in the form of the FT-290R. As an over-the shoulder battery-powered portable, it draws only 100 mA in receive mode, feeding a rubber duckie out a front-panel BNC. But if you want an automotive rig, just unplug its battery pack, snap on a 25-watt amplifier, and hang it conventionally under the dashboard. Perfect! The complement of features is excellent, with ten memories, stored offsets, a call channel, low-power mode, various tuning steps, and so on—and its utility is enhanced by multimode capability (FM, SSB, and CW).

Of course, a rugged outdoor environment imposes some interesting packaging constraints. After puzzling over the problem for a while, I lined a front-panel cutout with channel rubber, supported the radio on a soft foam pad, and tied it down with four coil springs. A clear vinyl cover velcros over the console when the rains come, and the only problem with humidity so far has been in the helmet microphone assembly, far from the radio itself.

Audio I/O

It didn't take long to discover that a built-in helmet audio system is an absolute necessity—trying to handle a speaker-mike while pedaling, braking, shifting, steering, and binary-typing is too much of a juggling act. But here again I encountered problems with products made for typical consumer environments: lightweight boom headsets were

apparently not intended to be rained upon. Rain can have two deviation-killing effects: soaking up the high-impedance electret audio signal and wicking into the microphone tube.

It turns out, however, that a Plantronics headset does a quite passable job, especially if a foam ball is added to reduce wind noise and the capsule is sealed with lacquer to keep water out. The headset is mounted to my Bell Tourlite™ bicycle helmet via a baroque assemblage of brass, brazed in a moment of drunken inspiration by one of Eureka's premier kinetic sculptors. Shielded cables were routed between the styrofoam and the outer helmet shell, terminating in a 12-pin Lemo waterproof connector on the back that also carries stereo audio and power for the dimmable Sunburst "miners" lamp. (The net effect of all this is that I can be light-headed while listening to music and chatting electronically with local hams.)

Audio is carried from the brain-interface unit through an Autac coil cord into the bike's wiring harness, whereupon it enters the console system through another Lemo connector. Inside, an "audio nexus board" preamplifies the tiny mike signal with an LM324 and provides a convenient point for mixing in other modulation sources (touch tones, packet audio, speech synthesis output, and so on).

Because of the low levels involved in the mike circuit, this system does have a couple of problems. Sharp transients in adjacent harness wires appear on my transmitted signal, most notably those associated with the pulse-width dimmer of the helmet lamp and the 7" barricade flasher behind my head. A future modification will either change the microphone technology or add a preamp to the helmet.

Audio *out* of the radio, however, is easy. The Yaesu's speaker signal is piped into an audio bus structure, feeding the touch-tone receiver chip, the Pac-Comm packet TNC, a cassette deck, the console speaker, and the helmet. A separate mixer amp allows a variety of audio sources to serve this same bus so that, for example, people standing around the bike can hear synthesized speech ("Red alert! Biological life forms nearby..."), a sound generator chip, my voice carried over 2-meters, or a taped message—all through the console speaker.

Back at the helmet, I normally use the comfortable Plantronics ear insert, though I do have the option of piping the various sources into the stereo headphone channels to aid in spatial discrimination. A variation on this, published last year in *QST*, is in the process of being added to the HF system—comments in a later article of this series.

Antenna

I will not attempt to conduct a tutorial on 2m antenna selection here—I'll leave that black magic to RF engineers. I do have a couple of notes on the subject, however.

It is well-known that ½ wave antennas require little or no counterpoise, while ¼ and ⅝ units depend on them. Although a quarter-wave whip works OK on a massive recumbent bicycle (Maggie, KA8ZYW, uses one), the half-wave is dramatically more effective. In pre-launch tests, I found I could hit the familiar Columbus, Ohio, 147.24 machine from about 5 miles further away on the bike than with my ¼-wave-equipped car. That convinced me.

The antenna is a Larsen Kulrod™ Special, and I have to commend the company on a remarkably rugged product. For thousands of miles the base mount has served as a handle for schlepping this 275-pound machine through doorways, up gravel slopes, and across unridable expanses of puddled grasslands...

Push-to-Talk

The only rational place for the PTT switch in a properly installed bicycle-mobile 2m rig is on the handlebar. Unfortunately, due to moisture, the component choice is non-trivial.

I faced the same problem here I had with the handlebar keyboard, though I eventually moved on to rubber-booted elastomeric units for smooth text entry. The ideal PTT would seem to be a good waterproof miniature push-button... but have you ever tried to find one?

> ***"There is no such thing as a trivial task where electronics are involved."***

C&K has a "sealed" product, but they are only intended to survive one washing cycle during automatic assembly. They also have no hysteresis whatsoever, and thus quickly become flaky and intermittent when corrosion sets in. I finally settled on a military-surplus sealed Microswitch with a quarter-inch bushing, further protected by a miniature rubber boot from AME. All this is Ty-rapped to the handlebar's substructure, siliconed, and smoothed over by layers of sculpted foam.

On Maggie's bike we used an Omron miniature pushbutton with a C&K keycap epoxied on. Though it has very little travel, there is quite enough tactile feedback to provide a pleasant switching sensation.

Power

Every ham who has ever watched a hand-held radio abruptly die because of the power curve of internal NiCads is already acutely conscious of the problems with batteries. On the bike, the difficulties were compounded by a variety of loads, the need for redundancy, random charge/discharge cycles, and a lack of home-base spares. For the Argonaut in the trailer, I use a 4 amp-hour NiCad—I can run it down properly, give it a full solar charge, and hit the airwaves again. But for day-to-day 2-meter operation, I chose Gates starved-electrolyte lead-acid cells, packaged by PB Energy Options of San Mateo, CA.

I'll save the details of this for May's column, which will deal exclusively with the solar-charged 7-voltage power system on the bike. But as far as the Yaesu 290 is concerned, I have two 5 amp-hour batteries set up to drive a pair of 12-volt buses. Bus A runs computers, switching power supplies, and the like; bus B handles the radio and all lights. The logic here is that on long night rides I can live without the computers... switching battery A onto the B bus as a fresh backup when the low-voltage warning light starts to blink.

QRZ... Bicycle Mobile?

As I noted at the end of last month's feature, the Winnebiko's 2-meter rig has proven to be an essential component of my nomadic lifestyle. It keeps my relationship with Maggie healthy during times of road-stress, frees us to stray a few miles apart when scouting local resources, and—very significantly—opens doors across the land. Riding through Titusville last night, we were invited to an impromptu gathering at the local IHOP. Hailing the Brunswick, Georgia, repeater from the Hostel in the Forest a couple of weeks ago netted us an invitation to a delightful Christmas party... which turned into a 2-day stay. Everywhere we go, the ham community makes us feel at home.

If my bike-mobile HF and packet systems are a form of sophisticated play, then the 2-meter installation must be viewed as basic survival. And that's why a carefully integrated design pays off. For the same reason that you wouldn't wire a house with duct tape and extension cords, a ham station in daily use must be smooth and free from irritating kludges. Cheers from Florida, and see you next month...

NOTE: Steve's book, COMPUTING ACROSS AMERICA is now available ($12). For information about his book, or the quarterly publication of road tales "The Journal of High Treknowledgy" ($13), as well as CAA T-Shirts ($11), contact: Computing Across America, 1013 Warren Avenue, Cary, NC 27511.

Steve and Maggie are currently taking a break from full-time pedaling to do a book promotion tour with the bikes in a 35-foot converted school bus, which serves as their mothership. If you would like to invite them to appear at your local hamfest or club meeting, contact their manager, Paul Jaeger, at the above address or phone 919/467-4806.

To contact Steve directly, try the GEnie network as WORDY. Over 50 chapters of his on-going adventures and technical commentary are in an area called CAA. Access is $5/hour during evenings and weekends; to sign up, use your modem to call 800-638-8369 and type HHH when connected. At the U#= prompt, enter control-R followed by XJM11878,GENIE. The system will take you through a signup procedure. Have your checking account or credit card data ready. ■

The 10-Meter Beam for $4

Great returns for minimal money.

by Peter A. Bergman N0BLX

A title like this usually implies that the author has several PhD's and owns shares in the local aluminum tubing industry. The reader, in the end, is left with his enhanced Novice privileges, a wire dipole on 10 meters and a hole in his pocket. By way of contrast, this author just wants to share a success story on what to do with the gift of a non-working television antenna.

In the Beginning

It all began one day when the XYL walked into the shack and said, "Honey, I know that you are having a great time on ten meters but wouldn't it be better if you had a tri-band beam like those other guys? What do they cost?" My response elicited, "Oh! That much? And you'll need a bigger rotator?"

A good hard look at Orr's Handbook, [1] a re-examination of an old TV antenna, and a discovery trip to the junk pile in the woods with tape measure and pliers followed. Gold! Well, nearly as good: another (very bent) TV antenna, a ten foot pipe, and a five-and-a-half foot section of steel tee-stock.

The Handbook had a description of a two-element yagi that could give 5.5 dB of gain and a front-to-back ratio of 7 to 15 dB. The second element, the parasitic element, could become a reflector—in which case it should be about 5% longer than the driven element—or a director if cut about 5% shorter. Using the parasitic element as a director gives slightly more gain and the advantages of a shorter element with the mechanical advantages of reduced weight, turning radius and wind load.

The Handbook yielded the following formulas;

Driven Element Length (feet)
= 476 ÷ frequency (MHz)
Director Length (feet)
= 450 ÷ frequency (MHz)
and Element Spacing (feet)
= 120 ÷ frequency (MHz)

Assembling the Materials

A 28.400 MHz center frequency (the phone sub-band) required about 16′ 9″ for the driven element, 15′ 10¼″ for the director, and an element spacing of 4′ and 3″.

The $4 Ten-Meter Beam Materials List:
2 each junk TV antennas free
2 each 1½″ x 4″ u-bolts $1.80
1 each 100 pF variable cap. 1.00
Small nuts, bolts and Misc. 1.20
Total: $4.00

References:

1. Radio Handbook 21st Edition by William Orr W6SAI
2. ARRL Antenna Book, 1974 Edition

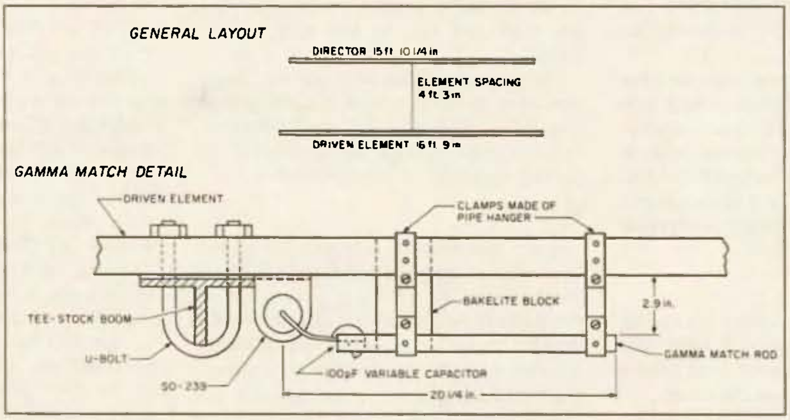


Figure 1. General antenna layout and Gamma match detail. #14 wire connects the SO-239 to the variable capacitor. The antenna resonates at 28.400 MHz. The SWR across the ten meter Novice band (28.1 to 28.5) ranges from 1.18:1 to 1.6:1.

Disassembly of the inherited TV antenna provided a 13′ piece of one-inch aluminum tubing; 10′ of one-inch galvanized pipe; a couple of pieces of ¾″ aluminum tubing 45″ long; and several pieces of ⅜″ aluminum tubing between 36 and 48″ long held together in pairs by mounting brackets. The harvest included a handfull of wing-nut bolts, a couple of bakelite blocks measuring 4″ by 2″ by ½″, two usable u-bolts with nuts and lock-washers, an assortment of little brackets, and two chunks of boom from the second antenna that could telescope into the water pipe.

The various bits and pieces laid out were evidence that a ten-meter mono-bander was about to take shape. If the new antenna would be small and light enough, that small TV rotator could handle the additional load.

A pair of the ⅜″ diameter tubes attached to each end of the 13′ former TV boom with ¼″-20 bolts yielded a driven element more than 17′ long. Connections with U-bolts enable length adjustments without cutting.

The ten-foot piece of pipe was stretched in similar manner. A couple of feet of aluminum tubing were telescoped into each end and secured with bolts before adding the former TV elements.

The tee-stock was next drilled to accommodate a two-foot triangle of counter-top material that had been "weather-testing" behind the clubhouse. After adding a pair of U-bolts, this assembly provided a secure mount to the mast.

Antenna Matching

Three methods of matching were available. The Delta-match would have required a matching section about

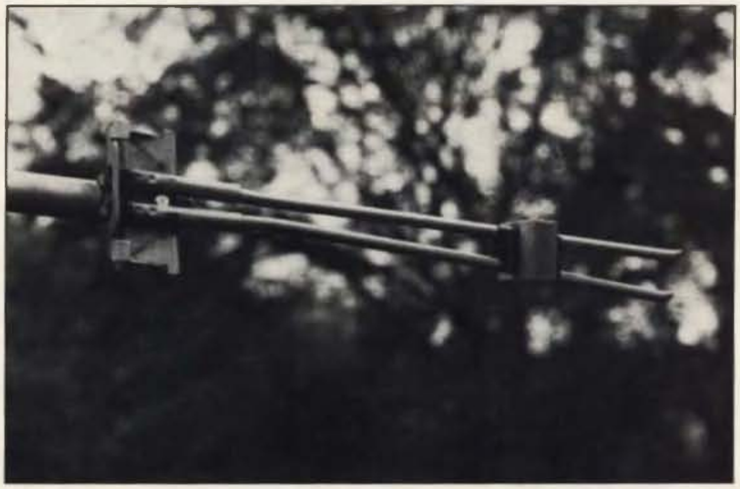
meters. My very meager junk box produced only one 100 picofarad variable capacitor. Back to the drawing board.

The Delta-match might be cheap, and the T-match might be a little bit more efficient, cheap—just one matching-rod one-third the diameter of the driven element and one variable capacitor.

A 20" scrap of aluminum close to the recommended diameter served as the matching rod. A pipe hanger strap became a clamp, and one of the bakelite blocks became a support for the driven end. The driven end of the rod was flattened and holes drilled to mount the capacitor. After final adjustments the capacitor was covered with a plastic vitamin bottle. Following the formula in the book, the Gamma-matching rod was spaced 1.70 of the length of the driven element from the driven element.

Photo A. The completed beam is in place a few feet below a two-meter antenna. The end detail of the driven element displays the spacing of the rods which affects the tuning. 1¼" at the ends works best.

Photo B. Close-up of the Gamma match and the organic rotator. The variable capacitor has been covered with a plastic bottle and tape.



The Tuning Process

One of the numerous little brackets was reamed out to mount an SO-239 to the boom at its junction with the driven element. A short piece of #14 copper wire connected the center pin of the SO-239 to the stator of the capacitor. Soldering and clamping the coax directly to the antenna is a possibility, but the convenience of the connector is worth the 75 cents.

After assembling the antenna, a wooden step ladder served as a temporary mount for the tuning process. First, the antenna element lengths and spacing needed adjustment to optimize reception. Ideally, use a low-power transmitter feeding a dipole at the height of the antenna being adjusted and located several wavelengths away. otherwise, manually rotate the antenna to peak the signal strength of operators near the target frequency. Then trim the elements and adjust the spacing for signal improvement. If the reference signal fades, just hunt for another.

More and better test equipment makes transmitting adjustments more precise, but my Hot-Water 101 and a homebrew reflectometer served well. The Gamma rod clamp and the capacitor were adjusted for a maximum forward and a minimum reflected reading.

The antenna was installed at a height of 24 feet—only about 70% of a wave length above the ground and only 6% above the house. Yes, higher would have been better, but according to the Antenna Book [2] the wave angle could sometimes be as good as 20°.

Conclusions

Does it work? You bet! Stations barely heard with the dipole really peak up on the yagi. I get consistently better signal reports with the yagi, too. Some stations think I use an amplifier. Amplifiers are great, but they are more complex, more expensive, and do not help on receive. Comparing a beam with an amplifier, the former will definitely offer more bang for the buck.

It may not be the most technically sophisticated antenna around, but for $4 and a few afternoons of work with the family the returns are greater than can be measured on a signal-strength meter!

Want to improve your signal in and out? Scrounge around and build yourself a beam. Just avoid using two or three different types of metals, and get it up as high as possible—maybe build your own capacitor. Go ahead and try it. It could be the start of something big. 73

Peter Bergman can be reached at 902 NE 13th Ave. #15, Brainerd MN 65401. He is a jack of all trades who was attracted to ham radio because of its great public service potential.

73 Review *by Pete Putman KT2B*

Number 16 on your Feedback Card

Creative Design Co., Ltd.
Orion Hi-Tech
PO Box 8771
Calabasas CA 91302
Price Class: $119

Create X-209 9-Element 144 MHz Yagi

This medium-gain performer offers good design, light weight and great strength.

From Japan comes the Create 9-element "Long John" yagi for 2 meters. It's part of this company's growing product line in the USA. Distributed by Orion Hi-Tech in Calabasas, California, Creative Design Co. Ltd. offers a wide range of amateur products including rotors, towers, low-band antennas and even a unique log periodic antenna for 50–1300 MHz.

The X-209 is not really a "Long-John" design in the same sense as the old Hy-Gain models of the same name. It's a medium length (1.8 wavelength) yagi and offers about 14 dBi gain. The X-209 is a well-made antenna with some nice design touches.

CREATE X-209 "Long-John" 2m YAGI

Specification	Claimed	Measured
Forward Gain	14 dBi	n/a
F/B ratio	15 dB	14.5 dB
Sidelobe Rejection	n/a at-23 dB	
VSWR Bandwidth	4 MHz at 1.5:1	4 MHz at 1.3:1
Weight	8.25 lbs	n/m
Length	12' 2"	n/m

Easy and Secure Assembly

Photo A shows the assembled antenna. The first thing that grabs the eye is the unique boom. Its cross-section is neither round nor square, but more elliptical. The top and bottom of the boom—the sides parallel to the elements—are flat. The remainder of the boom is round. The effect is like putting a pipe in a vise and mashing it. The boom is also ribbed. It comes in two pieces, and the clamshell that holds them together is just a larger section of the same material, sawed in half and drilled out.

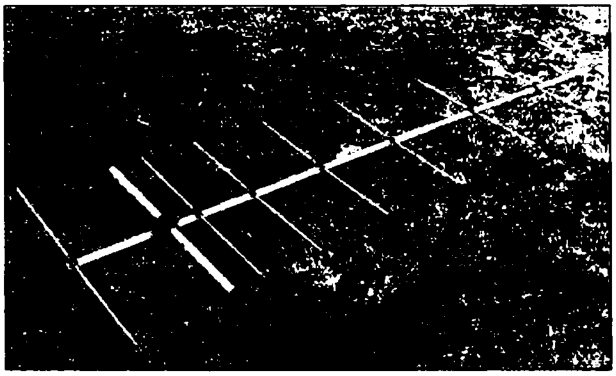


Photo A. Create Design X-209 9-Element 2-meter yagi.

All of the elements come pre-assembled and fitted to a center plastic-covered magnesium alloy brace. Each brace fits to the flat side of the boom to ensure a snug fit (à la Tonna), and each is also drilled out to accommodate the mounting hardware. The nut and lockwasher fit snugly against the other flat boom side, so element placement is a snap. To make things easier, each of the parasitic elements is color-coded to facilitate assembly.

The driven element is completely encapsulated. In fact, the weather-proofed housing, which has a drain hole on one end., contains the driven element and its coaxial balun impedance match. Simply attach what looks like a large gray plastic tube to the boom and connect the coaxial cable. As a result, it took me only a half-hour to assemble the beam. Start with the longest elements at the rear and work forward. Directions aren't even necessary.

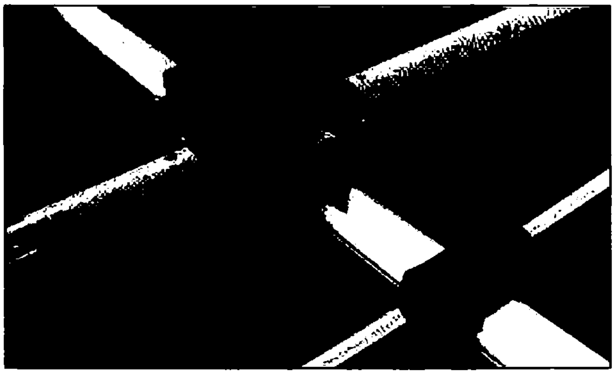


Photo B. Close-up of the Create X-209 showing the encapsulated driven element.

The Manual

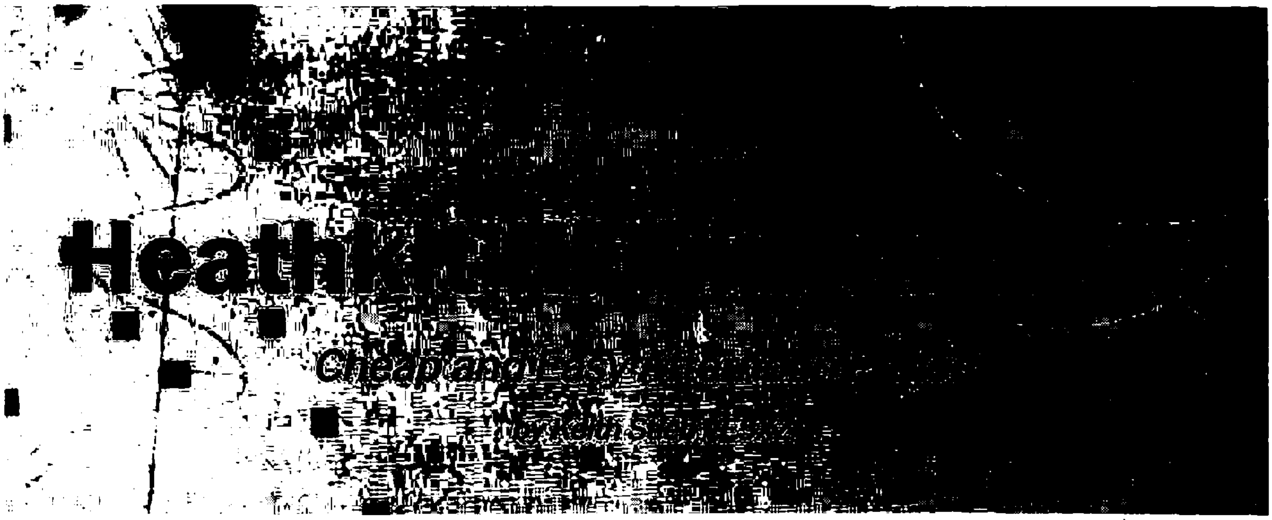
Most of the instructions pertain to stacking pairs of the X-209 or X-211 models. Very little information actually had anything to do with a single 9-element yagi. The manual could have been written more effectively, a problem not uncommon with even big-name manufacturers of imported equipment. This manual desperately needs a re-write, especially to reveal more pertinent information on the single X-209 yagi. The gain figures, F/B ratio, and polar plots are based on stacking two of these yagis.

The buyer should remove the assembly diagram and put the manual away somewhere. The driven element is sealed and cannot be adjusted. The elements are color-coded and go in place rapidly. It may take longer to attach the antenna to the mast then to build it!

Conclusion

I used the test set-up with the "quasi-tropic" radiator and 200 mW of power to make a few measurements. See the table for results.

The Create X-209 is a well-designed, lightweight antenna that is easy to assemble and very strong. It will yield satisfactory performance as a medium-gain yagi for either vertical or horizontal polarization modes.



The Heathkit SB 200-220 series of linear amplifiers have been around for years now. These linears have proven to be the workhorses of many amateur stations around the world. There have not been very many modifications made to these amplifiers. Obviously, Heathkit designed them right the first time.

The long-term dependability of the high-voltage series diodes comes into question after a review of the linear's schematic. These diodes are used in a full-wave, voltage-doubler circuit. Consultation with the *ARRL Handbook* and several technical manuals led to the following changes to the power supply.

Improving a Good Design

Figure 1 shows the original circuit, and Figure 2 illustrates the recommended modifications.

The basic changes are in the diode strings. The modifications include use of only four diodes on each string instead of six. Further, the new diodes carry ratings of 3 amperes at 1000 PIV. These diodes cost approximately 60 cents apiece. Use of higher voltage diodes and fewer in each leg of the supply would yield a cost far exceeding any gains. Because the diodes are capable of handling 3 amps, they can take any sudden current surges, which may occur during initial power up or rapid T/R switching.

A capacitor and a resistor parallels each diode. The resistor keeps the voltage constant across each diode when reverse-voltage is present. This prevents the first diode from taking the brunt of the initial reverse-voltage. The capacitors are there to absorb surges from the diode switching and anything else that could appear on the line. Voltage spikes could damage the diodes.

The 20Ω, 25W resistor serves a special function. It will limit the initial current surge in the high voltage supply at initial application of power. This is because the filter capacitors have no charge at the time and act like a short circuit until they do charge. This could precipitate damage to the rectifier diodes, or worse yet, the transformer winding! Commercial applications would switch this resistor out of the circuit after a few seconds by a time-delay relay. In this application switching is unnecessary.

The results of the power supply modification have been excellent. In the modified SB-200, the high voltage line increased about 300 volts, and power output increased by about 50 Watts.

Figure 1. The original circuit.

The Nitty Gritty

Users may exercise their own options to mount the parts required to complete the modification. One method is to solder the capacitors across the body of the diodes and to place the resistors to the foil side of the PC board. The 20Ω resistor can be mounted on this side as well. Some people may choose to mount the resistor on terminal strips located beside the PC board. Others may cut the PC board trace in appropriate locations and directly solder the resistor on the bottom of the board. This will depend on the size of the resistor.

This modification should be done on the SB-220 linear as well. Another diode in the series-string will keep a safety margin. If the manufacturer rates the diodes at 1000 PIV, for instance, a 750 PIV design rating builds in a 25% safety factor.

This modification doesn't take a great deal of time and can be classed as an easy weekender project for a stormy winter! ■

Keith VE5XZ has been a firefighter for seven years for the city of Prince Albert, Canada, as well as an emergency rescue instructor for St John's Ambulance. He's been a ham for 17 years.

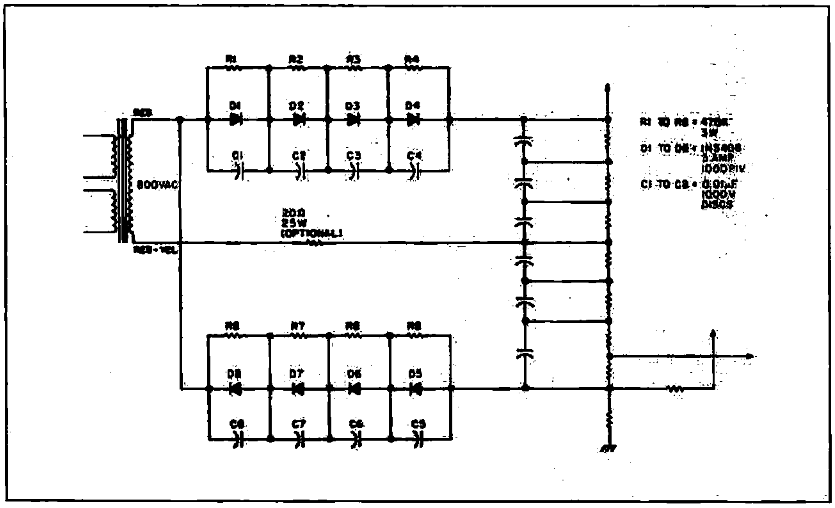


Figure 2. The modified circuit. The basic changes are in the diode strings.

Number 9 on your Feedback Card

10 Meter Meteor Scatter

No Sunspots Required!

by Larry Jones WB5KYK

Ten meters was alive and well with signals on August 12, 1987. The band even included the signals propagated by meteor scatter. The Perseids meteor shower took the Novices by surprise. QSOs were incomplete—most stations didn't know "ping mode" operation. Many stations later reported that this type of propagation was completely new to them. Yet, meteor scatter can be a useful tool to all operators interested in increasing DX on this band. Meteor scatter can make new states accessible.

Meteor showers occur at regular intervals each year. Nature keeps a very reliable clock. An almanac from any newsstand lists their dates as well as the *ARRL Handbook*. The 1987 handbook lists the following four major showers: Quadrantids (January 3), Arietids (June 7–8), Perseids (August 12–13), and Geminids (December 12–13). Both major and minor showers can help the experienced operator make long-haul contacts. Summer showers work best on a North-South path and the Winter showers work best on an East-West path at my QTH. Just experiment and see which showers and directions work out.

What It Takes

What kind of station does it take to operate meteor scatter (MS)? The best affordable receiver and, if possible, a preamp. It can mean the difference between a completed contact or a near miss. MFJ and Palomar make RF switching units that work well for 10-meter meteor scatter and can handle up to about 350 watts. A speaker with audio filtering is an asset along with a good, comfortable set of headphones. Enter the world of weak signal work.

A meteor leaves a trail of ionized gas as it travels through the ionosphere. This ionized trail reflects radio signals but is usable for a very brief time. The better the receiver, the longer the useful period of ionization. When this column of ionization is lost, there is a wait until another meteor enters the atmosphere.

The transmitter should operate CW or SSB with at least 100 watts output. CW is the most effective mode for scatter work because of the weak signals involved. Numerous Novices exercising their 10m phone privileges are audible via 10 meter meteor scatter.

Table 12. Calendar of the main meteor showers

Start	Dates of Maximum	End	Name	Comparative rate*	Transit Time	Elev
Jan 01	Jan 03	Jan 06	Quadrantids	6	09	90
Apr 19	Apr 21	Apr 24	April Lyrids	3	04	70
May 01	May 05	May 08	Eta Aquarids	3	08	40
Jun 10	Jun 16	Jun 21	June Lyrids	2	01	70
Jun 17	Jun 20	Jun 26	Ophiuchids	2	23	20
Jul 10	Jul 26	Aug 15	Capricornids	2	01	20
Jul 15	Jul 27	Aug 15	Delta Aquarids	4	02	30
Jul 15	Jul 31	Aug 20	Pisces Australids	2	02	10
Jul 15	Jul 30	Aug 25	Alpha Capricornids	2	00	30
Jul 15	Aug 06	Aug 25	Iota Aquarids	2	01	30
Jul 25	Aug 12	Aug 18	Perseids	5	06	80†
Aug 19	Aug 21	Aug 22	Chi Cygnids	1	21	90
Oct 16	Oct 21	Oct 26	Orionids	4	04	50
Oct 20	Nov 08	Nov 30	Taurids	3	01	60
Nov 07	Nov 09	Nov 11	Cepheids	2	20	80†
Nov 15	Nov 17	Nov 19	Leonids	2	06	60
Dec 07	Dec 14	Dec 15	Geminids	5	02	70
Dec 17	Dec 22	Dec 24	Ursids	1	08	60†

*Each step on the comparative rate scale represents a factor of 2.
†Above northern horizon.

Table 1. Major meteor showers occur with predictable regularity. Their dates can be found in the ARRL Handbook *and almanacs.*

Packet can be used on meteor scatter. Some operators use 2m packet successfully, and this mode has potential for 10m, too.

Most QSOs made via meteor scatter are with skeds. The blind calling that occurred on 10 meters during the Perseids is a good example of the need for skeds in meteor shower activity.

Antennas

The subject of antennas and meteor scatter is controversial. Some operators prefer to use a non-directional antenna for receive and a high gain antenna for transmit. The advantage of using the same antenna for transmit and receive is simple. Working skeds via meteor scatter, operators must know relative directions of the other stations. One antenna insures listening in the exact direction of transmission.

The high gain monoband beams that are on the market today are good for meteor scatter. Cushcraft, Create, KLM, and Hy-Gain market monoband beams for 10 meters. The higher the gain the better. Beam antennas must get a minimum of 10 dB gain over a dipole antenna to be successful with meteor scatter.Quads are not satisfactory on meteor scatter, but big wire antennas work well. I use a 5.25 wavelength inverted L that operates against 17,032 feet of buried radials.

The antenna should be in a clearing, or at least above any nearby obstructions. A tilt angle of 11 degrees works well on meteor showers from this location with a beam. However, when using a beam a slight tilt upward will help, regardless of the exact angle. It is possible to work stations on 10 meters (and 2 meters) with antennas at the 30′ level. Use the best feed line available like Belden 9913. Low loss and high gain will make a meteor scatter antenna system successful.

Verticals with a good radial system will work on 10m meteor scatter, too. Here, the gain of a beam is replaced with the efficiency of a vertical operated against a big radial system. It takes a lot of work to put down a good radial system, and the vertical *must* be in the clear. Using a vertical with less than 60 radials was largely unsuccessful.

A heavy duty power supply is essential because transmitting for long periods is the norm on some skeds. It is also helpful to have a programmable keyer for CW contacts.

Scheduling Contacts

Most meteor scatter operators make schedules by checking the contest results (10 meter) and writing these active 10 meter operators to ask for a sked. Some stations use on-the-air contacts to arrange skeds. Others use stations listed in 10-10 International's newsletter to obtain the calls of active 10 meter operators who might be interested in a sked. The 10m meteor scatter gang is loosely organized and does not yet have a list of stations interested in this form of propagation.

Once the date, time, and frequency have been established, the operators must establish a transmitting and listening rota. Experienced meteor scatter operators transmit in 15 second intervals. By established convention, the station farthest west should transmit the first 15 seconds of the minute, listen the second, transmit the third period and listen the fourth period. Operating discipline and attention to detail are *essential* for a successful contact.

Also establish a time frame to keep the sked going—generally for a maximum of 30 minutes if contact is unsuccessful. Have an accurate clock in your shack set exactly with WWV, because timing is critical in meteor scatter work.

> ***"Contacts are valid only when both calls and reports have been sent and received."***

Active 2m meteor scatter operators are good sources of information on the best scheduling times and related activities. Accurate activity logs are essential for meteor scatter predictions. Always keep track of attempted schedules, transmission times and directions, and any stations heard but not necessarily worked. These activity logs will ultimately serve as the basis for reliable scatter propagation predictions, and more successful contacts will follow.

Naturally, most meteor scatter opportunities occur at the peaks of respective meteor showers. The date of a shower's peak can be found in the references listed previously. Try to arrange a sked or two prior to the peak dates. Meteor debris preceding the main body of the shower will frequently cause enough ionization to allow successful contacts. It takes a long time to complete this type of contact, since the periods of ionization are short (1-3 seconds), and many minutes can pass before another period occurs.

Speak quickly during SSB contacts, or send as quickly as possible with CW. Fifteen seconds is not a lot of time to convey information. Then *listen*. Listening is paramount in weak signal work.

Signal Reporting

During the actual contact, signal reports may be given in one of two ways. The first is to report as usual with information to the station about his signal strength or, if on CW, about the RST. The second way is to tell the other station how long the meteor burst lasts. (S3 = 3 seconds, etc.). The two stations operating the sked should agree upon their reporting system—most 10m operators use signal strength reports because bursts on ten meters last longer than on the VHF bands.

Sample sked: NY station—agreed on signal strength reports; sked run on 28.392 at 1230Z UTC on October 21; operator farthest west transmits first on USB; sked will end at 1300Z UTC unless signals are being copied (if so, until 1330Z).

Sample first 15 seconds: "W2...this is WB5KYK (repeat as often as possible in 15 seconds). Over." Listen during the next 15 second period, and the W2 will transmit the same. If I copied the W2, then during the third 15 second segment I will send, "This is WB5KYK, S7, S7, S7 (repeat his report for 15 seconds). Over." If the W2 has copied, he will send my report as I sent his for a 15 second interval. If he had not copied my report, he would call me rather than send a report. Don't waste the burst time by sending unnecessary information.

In the first or third time frame never send a report until calls are copied. In the second or fourth time frame, never send a report as copied. Now, if I have copied his report, I acknowledge *that* report by sending "This is WB5KYK, Roger, Roger, Roger," for 15 seconds. Contacts are valid only when both calls and reports have been sent and received.

Always QSL as soon as possible after a meteor scatter QSO. Meteor scatter operators have established a certain protocol for QSL exchanges, which depends on who requested the schedule. The station requesting the sked should be *sure* to enclose an SASE with the QSL card. Always let the station that requested the sked QSL first, and respond to his QSL in a timely manner.

> ***"Listening is paramount in weak signal work."***

A Wrap-up

Meteor scatter is not the place to discuss antennas, rigs, or chat. A QSO can be as short as a few seconds. Meteor scatter is for sharp operators and those who want to acquire operating skill. The QSOs will appear difficult at first, but the experienced operators are eager to share their knowledge with those who want to learn. They like to spin tales about that long-ago shower. Patience is essential—few QSOs go as smoothly as the example.

If you need help, drop me a line and an SASE. May all your bursts be long. ■

Larry Jones WB5KYK is an enthusiastic MS operator who wants to encourage others to enhance this skill. He can be reached at Route 12, Box 139C, Laurel MS 39440.

73 Review *by Arliss Thompson W7XU*

Larsen HT Antenna Review

Larsen Electronics Inc.
11611 NE 50th Ave., PO Box 1799
Vancouver WA 98668

Price Class:			
	KD4-144	¼-wave Rubber Duck	$9
	KD4-144-ST	"Stubby"	$9
	KD4-144-HQ	¼-wave Collapsible	$12
	KD14-2M-HW	½-wave Collapsible	$18
	BNCQ	¼-wave BNC Male connector	$8

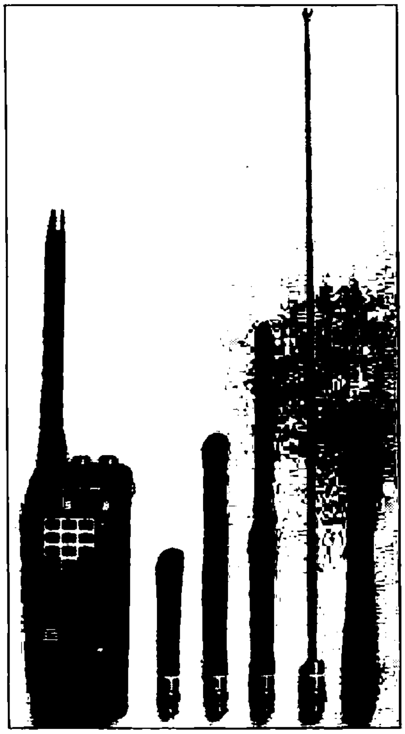


Photo A. (From left to right.) Kenwood TR-2500 handheld 2m transceiver with stock rubber-duckie, stout helical, standard rubber-duckie replacement, helical quarterwave, full-size ¼-wave, and collapsed ½-wave.

A ham often considers replacing the rubber-ducky that came with his handie-talkie with something that has better performance or a more compact size. What gain do these high performance models actually have? On the other side, how far down does communication effectiveness go with a "stubby-duck?" Are they worth the extra money?

Trip to Larsen

I had the opportunity to visit Larsen Electronics, in Vancouver, Washington, and toured the facilities with Jim Villasana. (The making of the antennas alone is worthy of an article.) This visit ended with the loan of four Kulduckie antennas (KD4-144, KD4-144-ST, KD4-144-HQ, and KD14-2M-HW) plus a BNCQ ¼-wave (Photo A).

These 5 models well represent what's available on the amateur market for replacement HT antennas, ranging from the KD4-144-ST stout helical to the KD14-2M-HW collapsible half-wave.

Two-Part Test

The comparisons involved two types of tests. The first sought quantitative (dB) comparisons of a given model to Kenwood's TR-2500 stock rubber-duckie. The second part of the test investigated the relative gain of the antennas under typical operating conditions.

Testing

A large, flat area of farmland served as the test range. The receive system consisted of a 3-element vertically-polarized yagi mounted approximately one wavelength above ground; a two-meter receive converter; a Kenwood TS-130S HF transceiver; and an attenuation box calibrated in 1-db steps. This was the receive system. The transmitter was a Kenwood TR-2500 outfitted located a few hundred feet from the receiver. The HT was held in position atop a wooden stepladder during the tests. This allowed normal (i.e. head-level) transceiver use, and reduced variations in signal strength due to movement. These conditions were definitely not equivalent to an antenna test range. The reader shouldn't view these results as gospel. They were in line, however, with theoretical values.

The Results

See the results in Table 1. Using the collapsible KD14-2M-HW ½-wavelength antenna as a standard, a BNCQ full-size ¼-wave was about 3 dB weaker. I obtained the same result with a model (KD4-144-HQ) that uses a part helical and part ¼-wave construction (sometimes known as a rubber-duckie with a "stinger"). In theory the full-size antenna is more efficient.

The standard Larsen helical antenna (KD4-144) and the stock Kenwood antenna gave identical results at 6 dB down from the ½-wavelength antenna. The stubby KD4-144-ST was an additional 3 db in signal strength below the ordinary rubber duck, or 9 db weaker than the ½-wave. These results are in fairly good agreement with measured and theoretical values (also shown in Table 1) for similar antennas that appear in the RSGB VHF/UHF Manual and in Reynold's article ("The ⅝-wavelength antenna mystique") in the ARRL's Antenna Compendium.

Below is an operational discussion of each antenna.

Stubby Duck

1) This is the smallest antenna of the lot. It has an overall length of 4-7.16 inches (a standard rubber duck is about 7-½ inches long), and a diameter just a hair under ½-inch. Expect a signal roughly 3 dB down from a regular antenna. Around-town repeater operation, however, showed no difference between this antenna and the stock antenna. On somewhat more distant repeaters, the short antenna was a bit more sensitive to location than the regular duckie. There were no instances, however, when the stock antenna allowed access to a repeater that the stubby couldn't hit.

KD4-144

The HT's standard antenna and the Larsen equivalent gave identical results. The Larsen exhibited only a slightly better SWR at resonance than the Kenwood unit. Note that for antennas of this kind, even with differences in quality of materials and workmanship, one is as good as the other. Both are 5 to 6 db weaker than the ½-wave antenna described later, but are less than 20 percent of the larger antenna's length. This represents a very reasonable compromise between size and performance with a handheld radio and antenna.

Helical ¼-wave "Extended Duckie"

Some hams swear by this antenna, shown with the other antennas in Photo A. The version tested was 3 inches longer than the standard rubber duck and provided about a 3 dB increase in signal strength relative to that an-

Continued on page 78

73 Book Review

A to Z, RFI, and Transformers

Three Definitive Radio References

reviewed by Larry Antonuk WB9RRT

The Technology Dictionary
edited by Charles Battle
Master Publishing, Inc. 1987
6" x 9", softbound, 174 pages, $6

New on the shelves at Radio Shack these days is *The Technology Dictionary*, a paperback meant to keep the "business, school, or home abreast of meaning of terms of the leading-edge technologies". The dictionary contains 2500 current and not-so-current terms—150 of them illustrated with line drawings or photographs.

Covering everything from Abacus to Zero Suppression, the book leans heavily toward the computer and telephone installation fields. Amateur radio operators will find their hobby has, for the most part, been neglected. Terms like CTCSS, repeater, RF link, and handheld are missing. CW or PL are defined, although somewhat misleadingly. However, these deficiencies are more than made up for by the broad coverage of the computer and digital logic fields.

Rather than cluttering up the text with all the possible acronyms used in the electronics field (DPDT - See also Double Pole Double Throw), the editor chose to devote six pages in the front of the book to "Abbreviations, Acronyms, and Symbols". If the acronym is listed, it's a simple matter to look up the corresponding term in the dictionary section of the book.

The Technology Dictionary does its job well. Who uses a dictionary like this? The back cover lists "the layman, technician, professional, engineer, or persons just being introduced to the technology". The definitions read like test answers in EE 101—enough to show that you know what they're talking about, but not enough to prove that you really understand the concept.

Let's say you're at lunch with the boys, and the conversation swings over to "epitaxial transistors". You flip through *The Technology Dictionary* and find that an epitaxial transistor is simply "a transistor having a layer of crystalline material deposited on the original substrate material and oriented in the same way as the original substrate". Hmmmm. Does this mean that you can now leap into the discussion? Ask intelligent questions? Why do you eat lunch with people like that anyway?

A little knowledge may be a dangerous thing, but where else can you get dangerous for six bucks? *The Technology Dictionary* will make a great stocking stuffer for the electronic newcomer, college student, or buzzword enthusiast.

Radio Frequency Interference
edited by C.L. Hutchinson and M. B. Kaczynski
The American Relay League, Inc. 1987.
8" x 11", softbound, 75 pages, $4

The complete title of this work is *Radio Frequency Interference, How To Identify and Cure It.* This aptly sums up the contents of the manual. Every facet of the RFI problem is covered in detail.

The early chapters deal with the history of radio interference (would you believe as early as 1925?). Diplomatic concerns are given thorough treatment: the importance of an RFI committee, how to deal with the offended parties, and how to deal with the FCC, if necessary.

Recognizing the source of the noise is sometimes the most difficult part of the process. Two major categories cover various sources of RFI: interference *to* hams, and interference *from* hams to consumers. Once we understand the source of RFI, we can attempt to solve the problem. Practically every imaginable source of interference is covered. CB radios, ham transmitters, power lines, electric motors, water heaters—all with specific information on noise suppression.

The highlights of the book are found in the "Additional Sources of Assistance and Information" section. First is an address list of consumer electronics manufacturers, with a short description of how they handle RFI complaints. Next comes a bibliography of published material available on the RFI topic. The manual is finished off with a section on the available high-pass, low-pass, and power line interference filters. Attenuation figures and fourteen pages of frequency response graphs are given, all by brand name. This last feature will be of great use to anyone in need of a filter; all the research has been done!

Radio Frequency Interference is lacking in only one department, home and automotive computers. (Possibly saved for another publication?) At any rate, four dollars spent on this manual could save countless hours and untold aggravation. At less than the price of a movie ticket, it belongs on every ham's bookshelf.

Transmission Line Tranformers
by Jerry Sevick, W2FMI
The American Radio Relay League, Inc. 1987
6" x 9", hardcover, 132 pages, $10

In the preface, W2FMI gives us a hint as to the tone of his handbook. The author states that, while doing research on transmission line transformer theory, he came to the point where he could either have written six to eight research papers or published them all as a book. He decided on the book.

Transmission Line Transformers certainly reads better than the average research paper, but it's not exactly light reading. The book will be quite enjoyable, however, to those hams mainly interested in RF and antenna design, since it represents the first rigorous study of the various design parameters used with these devices.

Starting with a short history of the transmission line transformer, the author gives a complete mathematical analysis of the derivation of the unit. Information on how to design and build the various types of transformers follows, classified by application and impedance ratios. Complete chapters are devoted to baluns and to materials and power ratings. The final chapters concern simple home-brew test equipment used to test and refine devices built in the workshop. Photographs, schematics, and graphs are generously spread throughout the text, making the book much more readable and understandable.

While not a research paper, neither is this a cookbook. If you need a transformer for a specific application, you won't find directions on how to wind it. You *will* learn how to design it, however, a more time-consuming, but certainly a more rewarding approach. And once you've wound your coil, hooked it up, and it doesn't work (!), you'll be better prepared to figure out why.

As impressive as it looks on the coffee table, *Transmission Line Transformers* may be somewhat beyond non-technical hams. For the hard-core RF types, W2FMI has come up with a reference work that will find its place next to *The Antenna Book*, *The Handbook*, and *Solid State Design*, well used, dog-eared, and always within reach.

Ultra-Convenient Mobile Antenna for Two Meters

A Harada AM/FM/CB antenna on VHF

Ivan T. Lorenzen W4JC

The removable whip antenna may seem at first a necessary evil. It often needs removal before driving the car in and out of a garage. Another factor is frequent vandalism in shopping mall parking lots. It's a lot cheaper to remove the whip antenna and put it in the trunk than to repeatedly replace bent, broken, or stolen whip antennas.

Because removing this antenna was so inconvenient, however, I investigated the feasibility of using a 12-volt AM/FM/CB power antenna. After all, the two-meter band is very close to the 5th harmonic of 27 MHz.

In the spring of 1979, my car was equipped with a Harada Model TW-85 power antenna designed for AM/FM/CB. A Leader model LAC-897 two-meter antenna matcher with built-in SWR/Power meter plugged in between the transceiver and the AM/FM/CB power antenna. The power antenna worked great. I soon installed a duplicate antenna on the rear fender and permanently connected to it a home-brew matcher, similar to the LAC-897 circuit.

Field strength readings at several points around a 360-degree circle showed virtually no difference between the power antenna and the ⅝-wave base-loaded whip mounted in the same hole on the rear fender.

This system performed very well after installation on a new car in 1982, and July 1987 saw the system on yet another new car. The car dealer wanted to keep the power antenna on the trade-in, however, because a hole plug in the rear fender wouldn't look nice.

Using the MT-2

A Harada Model MT-2 AM/FM/CB power antenna went on the rear fender of the new car. It extends 42 inches above the fender in the raised position, like the previous model. This easily clears the garage door opening.

A little more experimenting on the current system showed that an even simpler matcher works perfectly. (See Figure 1.)

The transceiver is a Kenwood TM-2530A with a rated RF power output of 25 watts. After 10 minutes of continuous-transmit operation, the top loading coil in the antenna doesn't even get warm. (For high power, however, increase power in incremental steps and check for heating. Harada doesn't furnish RF power handling capabilities of their AM/FM/CB antennas.)

The MT-2 antenna comes with a 59-inch length of RG-58/U and a Motorola-type male connector. Since this length of coax works perfectly well with the simple matcher shown above, there is no point in shortening it to save a few tenths of a dB, and possibly run into unpredictable changes in impedance matching.

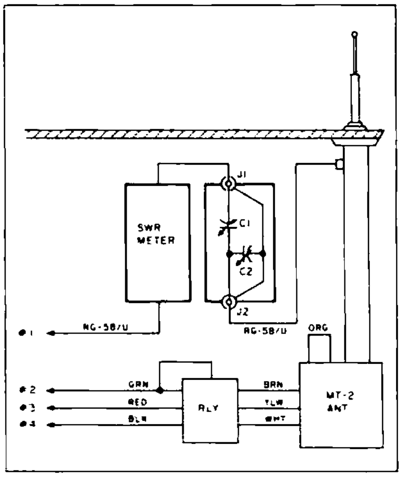


Fig. 1.

The parts list includes:

- **J1** SO-239 socket
- **J2** Motorola-type socket (Alternative: SO-239 and a Motorola-to-PL-259 adaptor)
- **C1** 15 pF air variable capacitor (ungrounded rotor)
- **C2** 15 pF air variable capacitor

The aluminum chassis box enclosing the matcher is approximately 2 x 2 x 4 inches with an SO-239 socket at the input and a Motorola-type female socket at the output. This prevents inadvertent reversal when making connections to the SWR meter and to the antenna. The SWR meter is a $20 generic Ham/CB type, approximately 2 x 2 x 5 inches.

For mounting ease on the car trunk, connect the SWR meter to the matcher side by side, using two M-359 right-angle adaptors and a double PL-259 adaptor. Mount the input SO-239 socket close to the edge on the end of the chassis box so the adaptor connectors will reach the two units. One or two home-made S-hooks made from heavy aluminum clothesline wire permits hanging the SWR meter/matcher on the fiberboard trunk liner.

The SWR is practically 1:1 with the plates of both capacitors approximately half-meshed. Comparative field strength readings are virtually equal to those of a base-loaded ⅝-wave whip.

One switch mounted near the transceiver turns the two meter rig on and raises the antenna. This antenna will cost more than a regular whip antenna, but the no-nonsense convenience and operational effectiveness of this setup is a real pleasure.

The author began his engineering career in 1933, working in commercial communications and broadcasting until joining the FCC in 1940. He retired in 1973 after service as Chief of the Monitoring Systems Division and Acting Deputy Chief of the Field Engineering Bureau. You can write to him at 320 Artemis Blvd., Merritt Island, FL 32953.

73 Review *by Bryan Hastings KA1HY*

WSE WP-727DX Docking Booster and Com-Rad CR2/4A Dual-band Antenna

World Systems Engineering Co., Ltd.
c/o Naval Electronics, Inc.
5417 Jetview Circle
Tampa FL 33634
Price Class: $349

Com-Rad Industries
1635 West River Rd.
PO Box 554
Grand Island NY 14072-0554
Price Class: $55

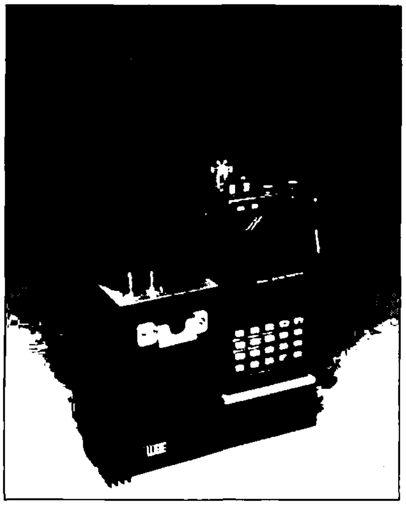


Photo A. World System's Electronics WP-727DX 2m/70cm docking booster, which accommodates five recent makes of Yaesu HTs.

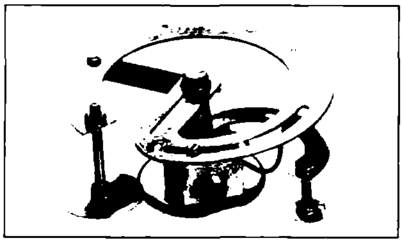


Photo B. Com-Rad's CR2/4A 2m/70cm mobile antenna. Shown here with the mag-mount, it stands only 4" high.

HTers may recall the Yaesu FT-727R 2m/70cm dual-band handie review in the December issue. The items reviewed here convert the FT-727 into a 18W/25W dual-band mobile station!

THE POWER BOOSTERS

World Systems Engineering's WP-727DX Docking Booster can be used with the Yaesu FT-203, -703R, -209, -709, and -727 HTs. The "boosted" HT in this review is the Yaesu 727R dual-band handie. It is an attractive and compact unit: a matte black aluminum case measuring 6" wide x 4½" tall x 2" deep. The 2" wide door mounting brace fits over the door panel between the inside face and the door window. The test vehicle was a Dodge Colt on whose door panel the booster fit perfectly.

The FT-727DX is a straightforward piece of gear. There are only two switches. One is a three-position toggle to switch the unit between high power, low power, and off. The other is a toggle to switch in the GaAsFET receiver pre-amp. The low-power setting switches the power amp out-of-line. Three LEDs, located on the top panel along with the switches, indicate power, pre-amp activation, and transmit mode.

RF power into the booster enters through a male BNC connector, and RF goes out to the antenna via an SO-239. There is a small mike-hanger bracket on the front panel. That, plus the 13.8V power cable, is all there is to it! The booster automatically selects the operating band and transmit/receive mode.

A Brief Look Inside

The components are sensibly mounted on a glass epoxy board, with heat-sensitive components on the lower, somewhat cooler, half of the vertical board. The solid-state final amp, a Toshiba S-AU3, is mounted on the left panel, looking at the front of the unit. The review unit mounted on the Colt passenger door panel, which positioned the final amp heatsink right in front of the car's air vent. Care was required when using the car heater to allow the sink adequate dissipation.

Operation

Mounting the FT-727 HT is also very simple—just remove the battery pack and slide it on the gray track. WSE should consider installing a securing bracket to bind the rig to the booster, because the 727 slid off a few times during the two-month operating period.

The "manual" is a single photocopied sheet, and it lists the booster's features, specifications, and operating cautions. The instruction sheet also shows a diagram of the top control panel and a photocopy of a photo of the 727 installed in the booster. There are no schematic or troubleshooting guides.

The booster didn't give a whit of trouble during its two months of casual use. The RF-sensed switching hardly slowed down even at times when the car's air temperature was near freezing. Signal reports were always Q-5 when solid into the repeater.

The booster in conjunction with the Untenna enabled me to regularly key up repeaters up to 50 miles away. On a recent trip from Ottawa to Montreal, I had solid access for 90 miles of the 120-mile distance to a repeater located halfway between the cities. On a previous trip along the same route, a 10-watt unit with a ⅝"-wave base-loaded whip gave solid access only 30 miles on either side of the repeater.

The GaAsFET preamp made a distinct difference in signal reception. S-6 signals became S-8 to S-9 with the preamp switched in.

A Bird Wattmeter and dummy load proved useful to measure power out of the booster on the high power setting for the two bands. At a hair under 14 VDC, 2m output was 28 watts, and 70cm output was 13 watts.

A problem could arise from the power line fuse in-line too close to the booster (a foot from the unit). More often than expected, the the DC-line insulation wears away at friction points, often on the metal edge of the car's firewall hole, through which the lines pass. The fuse should be as close as possible to the positive battery terminal to prevent shorting the battery. Check this potential hazard by putting another fuse in the positive line near the battery's "+" terminal.

THE "UNTENNA"

The Untenna was sitting at home on the coffee table home when a friend dropped by and, viewing this curious object on the table, commented on what a nice piece of abstract metal sculpture it was! It reminded another friend of an imcomplete heating element for an electric stove.

Clearly, the CR2/4A looks like anything but an antenna. It consists of two broad, flat, curved metal elements. It has a maximum diameter of 7 inches and, including the mag-mount, stands only 4½ inches high. It's hard to imagine that this little antenna's perform-

Frequency	144/430 MHz band
RF Power Output	30 watts/18 watts
RF Input Power	2–5 watts
RF preamp gain	15dB
Current Drain	6A Maximum
Input/Output	
Impedance	50Ω

Fig. 1. WSE WP-727DX Docking Booster Specifications.

Frequency	VHF	140–170 MHz
	UHF	430–470 MHz
Maximum Power		200 watts
Net Wt.		1.5 lbs
Height (with Radome)		5"
without radome and without mag-mount		2-½"

Fig. 2. Com-Rad CR2/4A Dual Band Antenna Specifications.

ance actually rivals that of a ¼-wave vertical! See the sidebar for a little theory on this low-profile antenna.

Antenna Set-Up and Tuning

Setting up the antenna takes just a few minutes, once fluent with the procedure (Refer to Photo B).

The antenna mounts on the roof of the car, with the SO-239 connector aimed rearward so wind doesn't force moisture into it. Connect the antenna to the rig with an SWR meter in-line for the desired bands.

First tune the impedance-matching lug, which slides along the groove in the element. This is factory set, so this tune can usually be skipped. The next step is to adjust the height above the ground plane (the car roof) of the capacitive tuning disk. This disk is located on the end of a threaded rod that drops down from the end of the radiating element. There is a lockwasher and nut on the threaded rod to secure it.

The steps are the same for tuning either the 2-meter or 440 MHz element.

Test and Performance

Preliminary tests at the *73* range concur with Com-Rad's claim that the CR2/4A has the gain of a ¼ wave whip. Comparing the CR2/4A to a ⅝ wave base-loaded whip, the signal reports on the test receiver for the two antennas were within an S-unit of each other. Consider this only an initial test. An RF attenuator is needed to more accurately measure the dB difference between the two antenna signals.

The CR2/4A is very high-Q antenna. Narrow bandwidth, by definition, reduces intermodulation (IMD), but limits the number of operable channels on the band without retuning. When the CR2/4A is tuned to resonate at 146 MHz, the operable bandpass is from 145.5 to 146.5. SWR is 3:1 at these two end frequencies.

The 440 MHz element was much more broad-banded. Minimum SWR was 1.25:1 at a resonant frequency of 445 MHz. This requires the tuning plate set as far away from the ground plane as possible. The SWR, however, went up only to 1:35:1 and 1.4:1 at 440 and 450 Mhz, respectively.

Operation

On-the-road use also showed the CR2/4A gain competes with the ¼-wave. The antenna didn't detune from the resonant frequency during the several months of operation. Small amounts of snow and ice on the elements do not appear to affect the antenna's tuning either. The test unit arrived with a protective plastic dome that attaches to the top of the antenna's vertical post, to keep it virtually snow- and ice-free. Buyers have an option of either a magnetic or Motorola-type NMO direct mounts.

CONCLUSIONS

The 727DX is a solid piece of gear in every respect. It is attractive, easy to use, well-made, and gave trouble-free operation. *73* tests for power output concurred with the maufacturer's tests, although the RF pre-amp gain was not checked.

Both preliminary dB measurements and operating experience indicate the CR2/4A has comparable gain to a ¼-wave vertical whip. Furthermore, it appears to be a solid, reliable antenna. The only drawback is its narrow bandwidth on two meters. The operator must retune the antenna if he wants to use a repeater more than 500 kHz off the resonant frequency. This antenna is ideal, however, for the operator who uses only one repeater, or a group of repeaters clustered together.

Thanks to Larry Antonuk WB9RRT who co-tested the booster and Untenna, to Arliss Thompson W7XU who provided printed materials on the DDRR, and to both for their technical assistance. Happy 2m/70cm mobiling!

DDRR Antennas

Directional-discontinuity ring-radiator antennas first captured engineers' interests in the early 1960s. Most of the early studies involved new designs for small, vertically polarized, omnidirectional HF antennas, but the theory applies to VHF radiators, also.

Vertical antennas are desirable for general purpose communications, since they offer omnidirectional radiation patterns. A grounded quarterwave antenna has very good radiation efficiency, since its radiation resistance is greater than any electrical loss due to conductor resistance. Shortened verticals that use loading coils to restore resonance become much more inefficient, since a shorter radiator decreases radiation resistance. A short antenna has less surface area (aperture) with which to radiate.

One way to shorten the vertical height of an antenna is to lay it on its side. The DDRR antenna does just that, yet the circular radiating surface area (aperture size) is the same as that of a full-height quarterwave antenna. A ten to 30 times reduction in height is possible with a DDRR.

DDRR antennas have some interesting characteristics. A circular antenna with a circumference of one quarter wavelength has a diameter of approximately 0.078λ. For the two meter band, the diameter is approximately 6½". The antenna's natural resonance is unaffected by height above the ground plane, provided this height is much than a quarter wavelength.

The area between the circular conductor and ground plane forms a curved boundary region or "slot." This slot initiates the radiation when a signal source is connected across it. Strictly speaking, the DDRR is a type of transmission line radiator, like a slotted waveguide. The horizontally polarized wave, which arises from the current flowing in the ring itself, combines with the complementary current image to cancel out all horizontal radiation. The vertically polarized radiation arises from the countinuous change of direction, or discontinuity, of the slot as it curves around.

The radiation pattern of a theoretical DDRR looks very much like a dipole's "doughnut" pattern. In the azimuthal plane the pattern is circularly symmetric; i.e., equal in all directions. In practice the radiation depends very much on the symmetry of the ground plane, and so a mobile VHF DDRR should be mounted as near as possible to the center of the vehicle's roof.

Impedance matching is carried out by adjusting the distance of the transmission line feedpoint from the end of the antenna. The DDRR actually permits direct connection of 30 to 500Ω transmission lines by adjusting the actual feedpoint. Once matched, the antenna can be capacitively tuned over a 2:1 frequency range without exceeding a 2:1 VSWR.

The bandwidth of any antenna is inversely proportional to its characteristic impedance, Z_o. A low Z_o implies large conductor widths and spacings, which subsequently mean a bigger antenna. Small antennas have relatively narrow bandwidths, and the DDRR is no different. In fact, the DDRR acts as a sharp bandpass filter at the resonant frequency, which can help reduce adjacent channel interference or intermodulation products in the receiver.

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Antennas In The Spring

An Ounce of Prevention . . .

by Bill Clarke WA4BLC

Ah, warm weather at last! It brings the urge to return to the great outdoors, to smell the fresh air and watch nature bud forth. It's also time to repair all the damage winter has wrought upon exterior amateur radio appliances such as antennas, feed-lines, and grounds.

Don't be Listless

Here's a handy list of things to do in the spring to assure the structural integrity and safety of antenna installations:

1. Examine all coax feed-lines, specifically looking for chafed, ripped, torn, or broken insulation. Replace any lines that aren't *perfect*. Openings in the outer insulation of coax cable allows moisture to enter. Moisture causes a degradation in the cable, better known as loss. These losses are more apparent at VHF frequencies than HF. Time does not heal damaged coax, and the losses will only get worse with age.

2. Check all coax connectors for tightness. Jack Frost apparently carries a pair of pliers with him and loosens coax connectors during the winter. Tighten each one, then apply a weather sealer to prevent moisture from entering the cables. The sealer shouldbe a high-grade silicon caulk, butyl rubber caulk, or one of the coax sealer products sold at ham radio stores.

3. Fasten all coax cable runs to solid support (tower legs, stand-offs, etc.). Using cable ties or tape, secure feed-lines tokeep them from moving. This reduces the chances of damage.

4. Look at all connections both in and out of the shack. Grounds work themselves loose over a period of time. Loose grounds can greatly interfere with reception, transmission, and signal patterns, in addition to increasing the electrical hazard. Check the ground conductors themselves. The aluminium wire often used for exterior lightning grounds sometimes breaks, leaving an antenna ground return running through the shack. Replace any questionable ground runs with copper wire and follow this golden rule: NO SPLICES!

5. Check all the tower hardware for tightness, including the guy line system. Jack visits there, too!

6. Replace rope halyards on wire antennas each spring. The sun's ultraviolet rays deteriorate most synthetic ropes in a year's time. Many hams wait until the ropes rot in two and fall to a handy working location on the ground. There are a few new rope products on the market that last for several years. Contact a marine store for more information on them.

"... follow this golden rule: NO SPLICES!"

7. Make sure wire antennas are secure and unreachable from ground level. Kids have a penchant for pulling on anything they can reach. Having a kid hanging onto the end of an antenna makes tune-up very difficult and is a little rough on the kid's fingers. Make this check and minimize the chances of a law-suit!

8. Make the tower inaccessible to local children! Towers are magnets for thrill-seeking kids. Fence in its base or, at the very least, place climb-resistant panels on the lower section.

9. Check the mobile installation. Check the weather tightness of the mount base, antenna attachment to the mount. Make sure coax connections are solid. Check and clean battery cables, then check the power cables going to the mobile rig.

Those are the basics! Here are a few extra tips:

- Galvanized electric fence wire works well for making wire antennas. It is also very CHEAP.
- Melt the ends of plastic/poly ropes to prevent unraveling.
- Place a few drops of contact glue on all rope knots. This will remind them to stay tied.
- Links of plastic decorator chain make fine antenna-end insulators. Use several (like a chain) for high power.
- Use drip loops on all feed and control lines at the entry point to a building. This helps to keep moisture out of the walls and window frames.
- Don't try to improve on 1.3:1 or less SWR. That level is quite acceptable. It's often more hassle than it's worth to try to lower it.
- Electrical service ground rods are better, and CHEAPER, than those sold at most radio supply stores. Be aware of the local galvanized ⅝" diameter rods that meet the local electrical codes.
- A steel fence post-driver pounds an 8' ground rod into the ground in about five minutes. Without working up a sweat.
- Use only stainless steel hardware on tower installations. It doesn't rust and is easily dismantled years later.

The most important tip for all:

IF IT AIN'T BROKE, DON'T FIX IT!

Now for a summer full of radio fun. No worries about anything falling down from the ravages of winter. Huh, what? Who said anything about cleaning the gutters and painting the house?

Bill WA4BLC is a frequent contributor to our pages. He has written several books and many articles on radio communications and aviation. His address is PO Box 2403, Falls Church, VA 22042.

Number 14 on your Feedback card

73 Review *by Pete Putman KT2B*

Tonna F9FT 20804
4-element 144 MHz yagi
Price Class: $45

Cushcraft 124WB
4-element 144 MHz yagi
Price Class: $58

CUSHCRAFT 124WB and Tonna 20804 4-Element 144 MHz Broadband Yagis

Two excellent choices for small yagis.

The real work-horse antennas on 2 meters these days are the 4-element broadband yagi. They're everywhere: In repeater service, atop a tower, stacked in pairs, at a portable communications site, backpacked up a mountain, even on a boat. The 4-element yagi represents the next logical step up for many 2m operators, such as the FM operator trying to make that distant repeater. . . the SSB maven trying some portable operation from the car. . . and the ragchewer who needs a simple gain antenna at his camp or cabin.

Varieties of this design abound, but this review will examine two prime examples, the American-made Cushcraft 124WB Boomer and the French-made Tonna 20804 yagis. Both are lightweight antennas that go together in no time at all. They employ universal end mounting for vertical or horizontal polarization. The antennas are designed to cover the frequency range of 144-148 MHz with no retuning, and they sell for under $60.

Some Differences

Figure 1 shows both antennas side-by-side. Notice the difference in boom lengths. The Cushcraft checks in at 48" while the Tonna measures 37". Allowing clearance for the boom-to-mast brackets, the Cushcraft measures 40" from reflector to driven element #2 while the Tonna has 31" over the same span. These numbers translate into .5 and .38 wavelengths respectively. From these numbers, both antennas should have fairly broad patterns with the Tonna slightly broader.

And they do. Cushcraft specifies the E (vertical) plane 3 dB beamwidth to be 60 degrees and the H (horizontal) plane to be 83 degrees. Tonna claims the E plane to be 58.6 degrees and the H plane to be 86.4 degrees. The latter is somewhat broader than the Cushcraft due to the shorter boom length. However, the numbers are very close—close enough to be called even. And as far as gain goes, Cushcraft claims 10.2 dBd (over a dipole radiator) and Tonna specifies 8.9 dBi (over an isotropic radiator). Two different rating systems are in use here, but I would assume that the real numbers aren't much different between the two.

Construction

Both antennas are extremely easy to assemble. It took all of 10 minutes to put the Tonna together, and the Cushcraft about 15. The difference In time can be attributed to the driven element assemblies—Tonna's is completely encapsulated and ready to attach with one screw. Cushcraft's requires the assembling and fastening of the two T-match sections to the driven elements. Both kits contained all of the hardware needed for the job, and both use stainless steel fasteners everywhere. Even the boom to mast clamp on the Cushcraft is completely stainless, a big improvement from past clamps. Tonna uses a galvanized clamp, which has resisted rust so far on my other Tonna yagis.

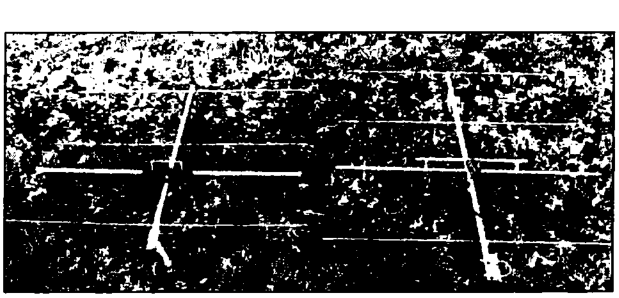
The Tonna parasitic elements each consist of a piece of aluminum rod with two dimples on it. The first centers the element in the stainless bracket. The second prevents it from sliding out of the bracket during shipping. Each bracket is attached with a wing nut—no wrenches needed. This makes for a portable antenna design since the elements can be folded back against the boom for transportation, with the driven element carried seperately.

The Cushcraft parasitic elements are also aluminum rod fitted to a drilled bushing. Reinforced aluminum brackets go on either side of the drilled hole to prevent denting the bushing and to hold it securely to the boom—a tried and true method used on all Cushcraft Boomers. A nutdriver is used to attach all of the elements. The Cushcraft can also be broken down for portable use, though not as easily as the Tonna. The procedure is quick, and the driven element can be attached as one piece.

As stated earlier, the Cushcraft employs the classic T-match which assures broadband characteristics at 2 meters. The Tonna match is a bit harder to see as it is encapsulated; however, Tonna also calls their design a T-match. The casing is hard black plastic for weatherproofing and no balun is employed. The larger Tonna beams use a ¼ wave decoupling sleeve. The feedpoint impedance is 50 ohms. Cushcraft does employ a coaxial balun

Four-Element Yagi Comparisons

Specification	124WB	20804
Gain (Manufacturer's claim)	10.2 dBd	8.9 dBi
F/B ratio (claimed)	19 dB	16 dB
(measured)	17 dB	15 dB
Sidelobe Rejection (claimed)	n/a	−13 dB
(measured)	−14 dB	−13 dB
VSWR bandwidth (claimed)	5 MHz @ 1.5:1	4 MHz @ 1.4:1
(measured)	4 MHz @ 1.2:1	4 MHz @ 1.2:1
Overall length	48"	37"
Weight	3 lbs	2.2 lbs



The Tonna (left) and Cushcraft (right) 4-element 144MHz yagis.

made from RG-11/U and also specifies a 50 ohm feedpoint impedance.

Performance

The test range was configured using a KLM "wet noodle" dipole driven element (the remainder of a KLM 4-element yagi that died on a DXpedition) atop a collapsible mast. 200 milliwatts of power at 2 meters were connected to this "quasi-tropic" radiator for the express purposes of measuring the front-to-back ratio and the sidelobe rejection of both 4-element yagis. I didn't bother to measure for gain, since it would have been difficult to substantiate. See Table 1 for the results.

No surprises here. Both antennas have about the expected sidelobe patterns for the number of elements and wavelength. Matching was excellent on both yagis. Setting the 124WB match to the factory suggested points required no further tuning. The Tonna, of course, is pretuned and cannot be adjusted.

Conclusion

Both the Cushcraft 124WB and Tonna 20804 are excellent choices for small yagis. These antennas are easy to build, use solid materials and work right out of the box. Neither one weighs much and could be installed practically anywhere—on a mast, tower, house, tree, flagpole. In short, they are versatile antennas for weak signal work, FM simplex and repeater operation, and packet stations.

73 Book Review

Number 15 on your Feedback card

Transmitter Hunting

The RDFer's Bible

Transmitter Hunting: Radio Direction Finding Simplified
by Joseph D. Moell and Thomas N. Curlee
TAB Books
PO Box 40
Blue Ridge Summit PA 17214
Price: $18

reviewed by Phil Nowak KA9KAF

This book is for foxhunters—those who hunt hidden transmitters for sport—whose technique makes everyone else look good. For those who are tired of searching through thirty years of DFing articles in an attempt to improve their skill, I highly recommend *Transmitter Hunting* by KØOV and WB6UZZ.

Basics of Fox-Hunting

It's an enthralling read, even for non-hams. The authors did an outstanding job in both comprehensive coverage of the subject and easy-to-read writing style. They start off simply to get the reader's attention and save the more technical and esoteric items for later.

There are two fundamental needs for transmitter hunting. The first is a means of telling the direction from which the signal is coming, and the second is some indication of signal strength. The authors, after a brief historical introduction, dive right into directional antennas. The reader discovers just how simple and inexpensive it is to build and use some of these antennas. For those with larger budgets, the authors cover more expensive and elaborate systems. Chapters two through four cover these antennas and show how to get started.

In chapter five, the readers get to the second fundamental and signal strength. As any foxhunter knows, the S-meter on most radios leaves something to be desired. This chapter is a gold mine of information on this subject. I personally favor the LED S-meter, because they are easy to read on night foxhunts.

Page 48 starts the discussion of extended LED meters. Page 50 has a schematic of how to build one. Chapter six thoroughly discusses attenuation. This is very important since most radios overload and lose their directionality when the hunter gets too close to the RF source.

Search and Rescue

The authors devote an entire chapter on equipping a vehicle for fox hunting. A number of specialized DF units are discussed. They clearly and skillfully explain Doppler DFs and the Little L-Per.

While most regard transmitter hunting as a sport, it has its serious side in the area of search and rescue. Chapter ten covers this topic. The authors discuss the various organizations involved in search and rescue. I can attest as a communications officer in the Civil Air Patrol that the techniques and skills are the same whether the payoff is saving lives or sitting around the munchies spot after a good hunt.

Questions came to mind such as, "Do they cover the subject of hunting on foot?," or "What about using computers to help?," while reading some of the earlier chapters. A resounding *yes* to both of these questions. The authors even cover using satellites for DF.

Toward the end of the book, the authors cover some of the more esoteric and expensive means of DFing. Some hams may remember seeing an OAR (Ocean Applied Research) unit at the Dayton hamvention a couple of years ago. The unit is fascinating, but its $20,000 tag, plus another eighteen hundred dollars for the antenna, daunts all but the most committed. The reader can read all about it, however, in chapter 19. This chapter also outlines the time-difference-of-arrival method.

There is a nice list of manufacturers and organizations in the appendix, and a very good bibliography.

Updates

There are a few errata and updates. Figure 12-7 on page 170 has S1 and S3 reversed in the schematic. The -94 at the bottom should be -9V. On page 313, the entry for A&A Engineering has changed. They are now at 2521 W. La Palma, Unit K, Anaheim CA 92801, (714) 952-2114. The Dick Smith DF unit is now sold by American Electronics, Box 301, Greenwood IN 46142, (317) 888-7265. The authors found some problems in the Dick Smith Doppler unit. See the July 1987 issue of *Ham Radio* for their changes to that unit. They received this information too late for publication in this edition.

This is an excellent book, well written, logically organized, and inexpensive. Anyone interested in radio direction finding should track down this book.

Foxhunters Unite!

Europeans have traditionally had numerous and very active fox hunting groups. Hidden transmitter hunting and radio orienteering are big-time sports overseas. Each year the teams from Eastern and Western Europe, Australia, Japan, and many other countries participate in the Radio Direction Finding (RDF) World Championships.

Surprisingly, these activities have had little support in North America. Although there are a number of clubs in California, the Midwest, and New York, most fox hunters are scattered few and far between.

***73 Magazine* would like to hear from clubs and individuals interested in organizing RDF sports on a national level. Regional and national RDF competitions in this country would ultimately yield a US National RDF Team to compete in the World Championships held in Europe each year.**

Send your ideas to *73 Magazine, RDF Ideas, WGE Center, Peterborough, NH 03458.*

Number 7 on your Feedback card

73 Review *by Bill Clarke WA4BLC*

Model DF Package

Datong Electronics Ltd. of Leeds, England
Units sold by Electronic Equipment Bank
516 Mill Street NE
Vienna, VA 22180
Price Class: $329

There is a passion for hunting something deeply implanted in the human breast. (Charles Dickens)

VHF radio direction finding (DFing) has always been a problem for the ham. Equipment was cumbersome and often hard to get. Datong's DF package changes this.

Datong is an electronics manufacturing firm based in Leeds, England. that designs and produces specialized radio communications devices. Hams may find many of their products useful. Among these is the Model DF, a doppler-based direction finder.

The DF is a complete direction finding system that works with an FM narrow band receiver to determine an RF source location. It's not necessary to modify the receiver to use this system. Hams can use it for many purposes, including tracking and finding jammers, and fox hunting.

Take a Look

The DF display unit is the black box that controls the system and shows the results. Three controls, two switches, and 18 LEDs are on the front panel. The 16 LEDs in a circle indicate the direction of the sought-after signal.

In addition to the display unit, there are the antenna combiner and four antennas. The combiner, model DFA1 or DFA2, is the second part of the Model DF package. It is weatherproof for outdoor installation. The DFA1 and DFA2 are identical except for a magnetic mount installed on the DFA2. The user has to supply the antennas.

Installation

Connect the assortment of plug-in cables between the components:

—Connect the display unit RF output to the receiver's antenna connector

—Apply 11-15 VDC to the back of the display unit connect the audio output from the receiver to the display unit and connect an external speaker

—Connect a rubber duck to the display unit for communications purposes (up to 20 watts RF may be transmitted through the system)

—Connect the coax line from the antenna combiner to the display unit

—Connect four antennas to the antenna combiner

The initial installation involves attaching the feedlines from the four antennas to the combiner box, which may take a half hour to do. It's only a one-time procedure, however. The antennas are permanently connected to the combiner box.

Coax installation takes a little grace. Each line terminates in a screw connector block. The easiest way to make coax connections to these blocks is by dressing the shield and center connectors very short, twisted, and soldered on the ends. These ends compress very nicely in the screw blocks. BNC connectors installed on the combiner would be easier for the user.

The only other fault was the dime-store power connector supplied with the DF unit. It's a typical round portable power plug like those found on many wall chargers. Not easy to solder and very low-quality.

The installer can carry out the initial test and calibration with a transmitter at a known location. A nearby repeater may prove handy for calibration. The process only takes two minutes. This gadget is really simple to use!

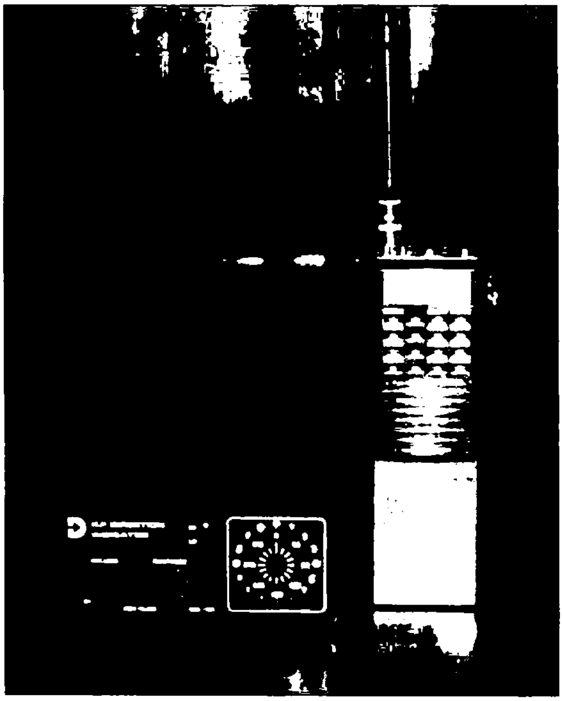


Photo A. The DF display unit. Note the circle of 16 LEDs on the front panel at left. Each represents 22.5 degrees of azimuth.

Photo B. Four mag-mount 2-meter antennas and the combiner on the van roof.

On the Road

I tested the unit in both fixed and mobile installations. The ICOM 2AT, ICOM 02-AT, Kenwood 7950, and ICOM R7000 were the test receivers for this evaluation. The Hustler VHF mag-mounts sat in the corners of a 12" square. I placed four mag-mounted ¼-wave two-meter antennas in a square on a piece of sheet metal, which sits on the car roof. This got the antennas into the clear.

Mobile operation was

CB-TO-TEN

73 has led the way on CB-to-10 meter conversions. Take advantage of our offer to help you get on 10 meters before the sunspots peak again. It's easy and saves you money!

#	Title	Issue
1	Bandplan and Crystal Info	May 77
2	Conversion Data	May 77
3	Radio Shack TRC-47	Jul 77
4	E.F. Johnson Messenger 123A	Jul 77
5	Hy-Gain 670B	Jul 77
6	Antenna Suggestions	Dec 77
7	Radio Shack Realistic TRC-II	Dec 77
8	The Publicom I	Feb 78
9	How about SSB Conversions?	Jul 78
10	Radio Shack TRC-11 and TRC-74	Aug 78
11	Radio Shack Realistic Mini 23	Sep 78
12	Hy Range 681A (Hy-Gain)	Sep 78
13	Kraco KCB-2310B	Oct 78
14	Lafayette Telsat SSB-75	Nov 78
15	Radio Shack Realistic TRC-452	Nov 78
16	CB Walkie-Talkie Conversion	Nov 78
17	Sharp Model CB-800A	Jan 79
18	SBE Sidebander III and Pace 123A	Jan 79
19	Midland 13-882C and Other PLL Rigs	May 79
20	Lafayette SSB 75 and SSB-100	Jun 79
21	Royce 1-655	Nov 79
22	Johnson Viking 352	Nov 79
23	CB to 10 FM - Part I	Jan 80
24	CB to 10 FM - Part II	Feb 80
25	More Talk Power for the TRC-11	Mar 80
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35	CB to CW? (Hy-Gain)	Jul 82
36	Maximum Modulation for CB Conversions	Dec 82
37	Beef Up Your CB-to-CW Conversion	Feb 83
38	Add a Digital Readout to Your CB Conversion	Feb 83

Send $3.00 for the first article and $1.50 each thereafter. Just choose the article numbers and call with a credit card number or send a check or money order to: *CB to Ten, 73 Amateur Radio Magazine, WGE Center, Peterborough NH 03458 (603-525-4201)*

very interesting. The impressive array of four antennas sat on the van roof, and the display unit rested on the dash panel. I calibrated the display to point to the front of the van.

The first DFing took place in a local shopping center on a hill. Parking lots located on hills offer good visibility to the eyes and to VHF DFing systems. From there, I got very accurate bearings on all the local repeaters, many mobiles on their inputs, and some simplex stations. I tried the system on various frequencies. It did very well for all FM applications from 20 to 220 MHz.

Although the 16-LED DF display indicates an area of 22.5 degrees, the actual working resolution is 11.25 degrees. This sounds like a large range for error, but when approaching the unknown transmitter, the span decreases in scope and loses importance.

After checking motionless operation, I drove away and followed the LEDs straight to the repeater site. The only problems during this mobile DF session were flutter, reflections, and shadowing caused by buildings and land contour.

Most VHFers are familiar with RF reflections. They cause multi-path and come from geographic features (hills, cliffs, etc.) and man-made objects (buildings, towers, and more). These reflections cause accuracy problems with any DFing system. The Datong Model DF is no exception. More important than reflections of the transmitted signal, however, is the location of the receiving antennas.

Receiving antennas located near reflective objects (other antennas, metal roofs, gutters, etc.) throw DFing accuracy way off. It's very important to place the receiving antenna system clear of surrounding obstacles. Mount the antennas as high as possible.

Tracking Tips

Topographic maps are useful, if not essential, because they show essential geographical details like elevation and contours. Both details are important when DFing radio signals that may be influenced (bent or reflected) by the "lay of the land." Other useful maps are the planimetric map, a linear information display of roads and other surface information, and the 7-½ minute map, a very detailed contour map.

Topographical maps (and other types) are available from:

USGS - NCIC
507 National Center
Reston, VA 22092
Phone: (703) 648-6045

Triangulation

Two DF stations several miles from each other can locate a transmitter by triangulation. Triangulation is easy. First, take an RF source bearing from two different DF station locations. Then, on the map, draw a line from each of the DF station locations along the bearing of the RF source. The intersection of the lines is the location of the RF source!

The Green Light

I recommend the DF system. It is useful, simple to operate, and relatively inexpensive. Repeater operators will find it very valuable for locating interference sources, identifying unknown repeater signals, and finding jammers. The fox hunters will revel in the ease of winning the hunt. . . until everyone gets one.

Bill WA4BLC regularly contributes to 73. He has written several books and many articles on aviation and radio communications. His address is PO Box 2403, Falls Church, VA, 22042.

Manufacturer's Specifications

Supply Voltage:	10–15 VDC
Supply Current:	400 mA maximum
Frequency Range:	20–200 MHz
Directional Accuracy: (after initial calibration)	± 5 degrees
Display:	16 green LEDs
Audio Power:	1.2 watts into 8Ω speaker
Dimensions:	
DF display	6.0 x 2.6 x 6.2 inches
DFA1 combiner	4.7 x 4.7 x 2.2 inches
DFA2 combiner	4.7 x 4.7 x 2.8 inches
Weight:	
DF display	18 ounces
DFA1 combiner	12 ounces
DFA2 combiner	25 ounces

73 Review

by Arliss Thompson W7XU

Maxcom Automatic Antenna Matchers

Maxcom, Inc.
1309 S.W. 5th Ct.
Ft. Lauderdale FL 33312.
Price Class: 200D $599
XLD-150 $299

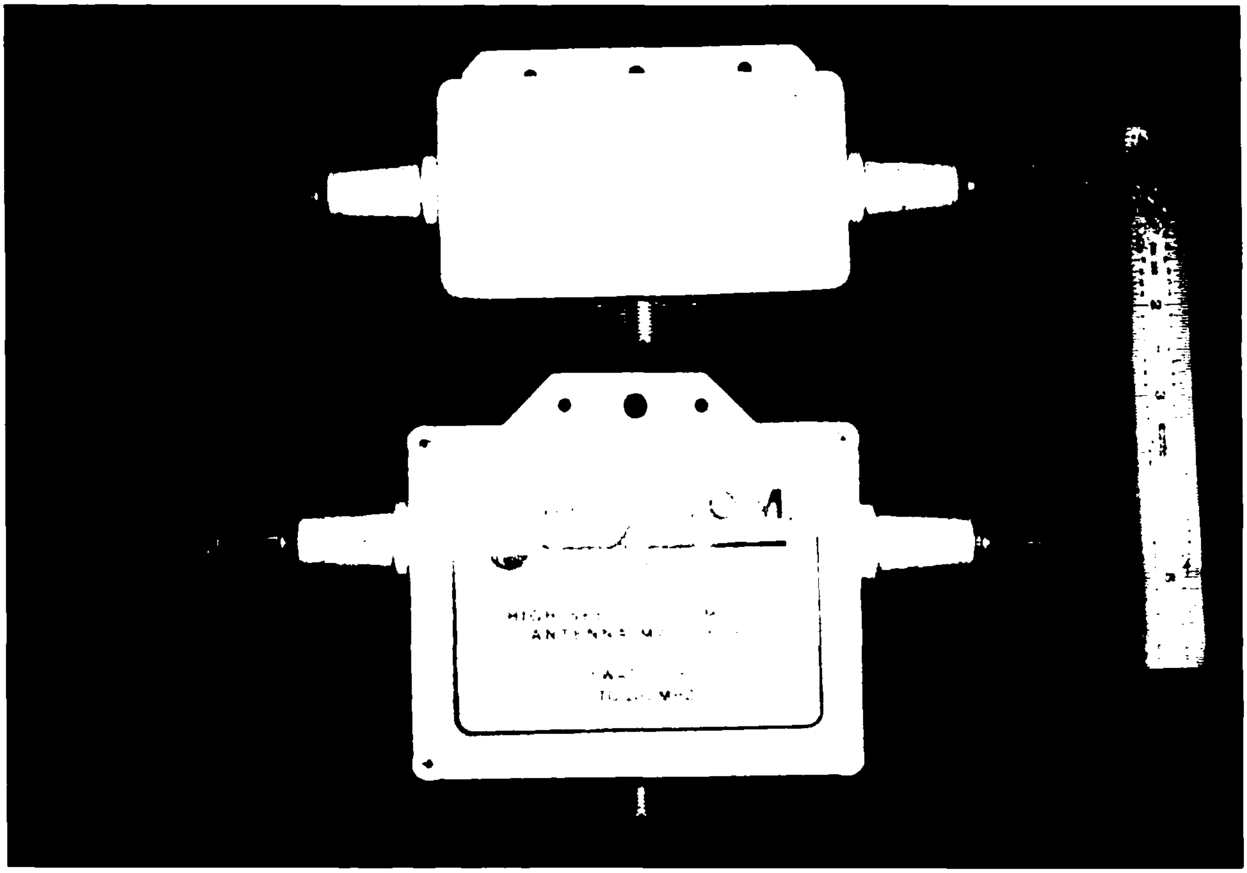


Photo A. Maxcom 200D (bottom) and XLD-150 (top).

You've seen the ads: "One antenna 100 kHz to 200 MHz . . absolutely no tuning . . VSWR 1.5:1 or less." Perhaps you've seen the reviews that have appeared elsewhere, which have ranged from the critical (Hall's "Product Review," November 1984 *QST*) to the enthusiastic (Gordon West's "Maritime Mobile" column, December 1983 *Worldradio*).

"So which is it?" you might ask. "Do the Maxcom units work or is someone trying to pull the wool over our eyes?" Given Maxcom's controversial history, I jumped at the chance to test two of their models for *73*.

The 200D and the XLD-150

I received the 200D (Maxcom's most popular) and the XLD-150 models for testing. The manufacturer's literature claims:

- high efficiency with instant matching over the specified frequency range;
- no moving parts; and
- no control leads.

Maxcom markets the 200D as a commercial model with a power rating of 200 watts in SSB service (derate 75% for continuous duty) that covers 0.1 to 200 MHz. The XLD-150, on the other hand, is a "utility" model designed for 1.5 to 30 MHz with a power handling capability of 150 watts, SSB only. The XLD-150 is smaller than its commercial cousin, and at 1.2 lbs is also a pound lighter. Both units take 50Ω coaxial feedlines and support a variety of installation configurations. The 200D carries a 5-year warranty, and Maxcom guarantees the XLD-150 for one year.

The Maxcom units initially impressed me as well made devices. Each is housed in a stout aluminum box finished in white enamel. SO-239 connectors accept the feedline, and the antenna legs attach to two ceramic insulators. The XLD-150 measures 3¼ x 9¾ x 1½ inches, while the 200D measures 4¾ x 10 x 2¼ inches.

You Can't Come In

I normally investigate the inner workings of an electronic device for review. I wanted to do the same with these tuners, but they are filled with epoxy. Removal of the epoxy could only damage the units. Unrelenting curiosity and X-ray equipment at my disposal, however, produced the pictures shown in the review.

The 200D appears in the accompanying photographs identical to the 200-watt model that appeared in the 1984 *QST* review. Note the toroid and several other devices, which are almost certainly power resistors. Maxcom's reply ("Correspondence," June 1985 *QST*) to Hall's review indicated that the "ferrite transformer is connected directly to the SO-239 input." Further, "the resistors in the unit. . .are connected to the output of the transformer to create additional RF loading." That arrangement was likened to a "dummy dipole" by at least one writer (M. Slavin, "Technical Correspondence," April 1985 *QST*), but some letters of recommendation included with the units I received indicated that Maxcom has some satisfied customers, including the U.S. Army.

I resolved to remain neutral until I had my own results.

Starting Up

Maxcom's installation instructions consist largely of a listing of the features of their units. The instructions briefly describe dipole, inverted vee, and longwire installations. There are also a few simple illustrations provided. The instructions could be somewhat more detailed and explicit, especially for non-amateur users.

Maxcom recommends a minimum length of 35 feet per leg for a dipole. Fifty feet per side are preferred, especially on the lower HF bands. Changing the installation from a dipole configuration to that of an inverted vee, according to the directions, produces little or no effect on the SWR.

I erected the Maxcom and all comparison antennas in the inverted-vee configuration. The Maxcom units were used with one of two antennas: dipoles 70 and 128 feet long overall. All of the antennas tested had their centers 30 feet above ground, with the ends a minimum of 6 feet above ground. The antennas were mounted in the clear, with the receiving position located several hundred feet away. I made signal comparisons using an attenuation pad calibrated in 1 dB steps placed in line with the distant receiver's feedline. The test arrangement assured a constant level of input power to the tuner regardless of SWR. All SWR measurements reflect the actual SWR at the input to the antenna.

SWR Measurements

I first checked the SWR response of the Maxcom units using the 128' dipole. Measuring at 50 kHz intervals, the 200D showed a maximum SWR of 1.5:1 over all the US amateur bands from 3.5 to 29.7 MHz. This dipole actually resonated at the low end of the 80 meter band, but surprisingly the SWR was the highest on that band, ranging from 1.4:1 to 1.5:1 across that band. On the other bands the SWR never exceeded 1.3:1.

The XLD-150 did not perform as well in this situation, showing an SWR of up to 1.8:1 on 80 meters and as high as 1.6:1 at the upper end of the 10 meter band. Elsewhere the SWR was less than or equal to 1.4:1.

I next measured the SWR for the two Maxcom matching devices when used with the 70' dipole. With the 200D, the SWR on 80 meters dropped to a maximum of 1.2:1 on 80 meters, but was a flat 1.6:1 across the 40 meter band. It ranged from and from 1.7:1 to 1.8:1 on 15 meters, but elsewhere it met or surpassed the specified 1.5:1.

The XLD-150 also gave a low SWR on 80 meters with the short antenna, but again the SWR on 40 was relatively high (1.7:1). The 10 meter measurements were consistantly 1.8:1 across the band. Failure to correct the SWR measurements for feedline loss would have shown incorrect measurements better than 1.6:1 over the frequency bands tested, regardless of which antenna was used.

Signal Strength Comparison

Low SWR present at the transceiver output doesn't mean the antenna radiates well. Therefore, for the next phase of the review I compared signal strengths on various bands, with and without the Maxcoms in line. Using the 200D Maxcom, I found the received signal strength (measured as noted above) at opposite ends of the 80 meter band to differ by up to 4 dB when using the 128' antenna. I was concerned that something was amiss with my measuring technique, but a check of the same antenna with direct coax feed showed at most a 1 dB variation in received signal across the band. Repeating the measurements with the 200D confirmed the original results.

"The Maxcom units initially impressed me as well-made devices."

With the Maxcom at the feedpoint, signal strength gradually dropped by 4 dB as the frequency neared 3.5 MHz. The XLD showed a similar response over that frequency range. Signal strength measurements on the other bands demonstrated a more uniform response.

Antenna Gain

Now for the big question: How much signal strength gain (or loss) can a Maxcom antenna matcher provide when compared with the same antenna fed with coax? Again with the caveat that these tests were not done on an antenna range, here's what I found.

With the 128 foot inverted vee operating on 80 meters, the signal from the Maxcom was typically 9 to 10 dB down from the same antenna directly fed with coax. On 40 meters, this antenna acts as two halfwaves in phase and has a theoretical gain of about 1.9 dB over a 40 meter dipole. When fed through the 200D, the signal from the long antenna was 2–3 dB down from a 40 meter dipole fed directly with coax. Allowing for the gain of the longer antenna, it appears the Maxcom is actually 4 to 5 dB weaker. Measurements using the 128' antenna on 10 MHz showed the Maxcom to be approximately 12 dB down. My experience shows that *resonant* dipoles outperform the Maxcom by at least 4 dB.

Other antenna arrangements will probably have different results.

Great for Some Applications

Are there any situations when the Maxcom system wins out? Yes, there are. In some instances the 80 meter dipole fed with a Maxcom matcher will give stronger signals than a nonresonant dipole fed directly with coax. Such a condition causes a high SWR to exist on the feedline, and that in turn causes feedline losses to rise, especially on the higher frequencies.

Suppose an antenna has a 3:1 SWR at the transmitter at 21 MHz, and the feedline has a nominal loss of 2 dB at that frequency. The high SWR will cause an additional loss of 3 db for a total of 5 dB feedline loss. Here, the Maxcom may very well outperform the nonresonant dipole fed directly with coax, especially considering nearly all solid state transceivers will operate only at reduced power output, if at all, when faced with a 3:1 SWR.

The Maxcom matcher in this case may still have relatively high losses, but with a low SWR present on the feedline other losses will be low, and power output from the transceiver will remain at maximum. The result is more radiated power is radiated with the Maxcom.

Cost Considerations

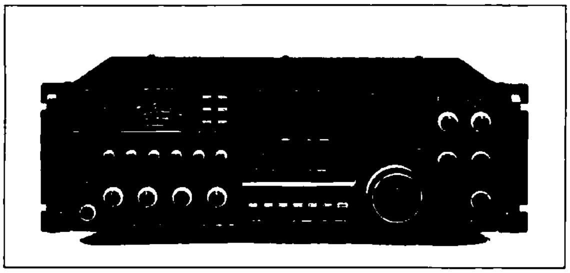
Maxcom Automatic Antenna Matchers are not cheap. Retail price for the 200D is $599. The XLD-150 runs $299. The buyer should balance the units' cost with other considerations such as power ratings and installation requirements. If the Maxcom has a place in the amateur market, it is for folks who like the convenience of coaxial feedlines, have room for one antenna, and primarily work stations with strong signals.

Photo B. X-ray view from above of Maxcom XLD-150.

Number 18 on your Feedback card

NEW PRODUCTS

Compiled by Rebecca Niemela



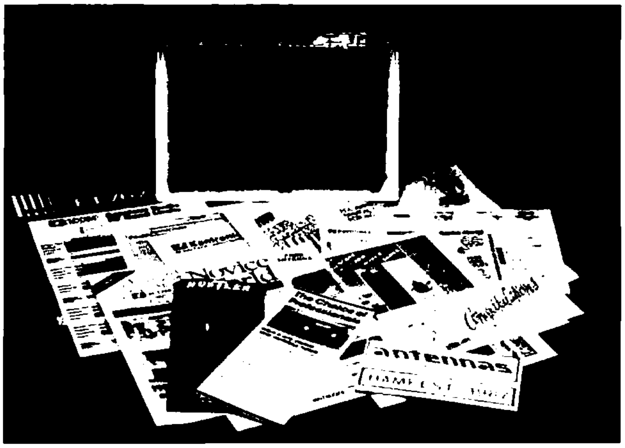
PRODUCT OF THE MONTH

ICOM's Dazzling IC-781 HF Base Station Transceiver

Every feature imaginable and some you wouldn't even have dreamed of are found in the IC-781. It operates all modes and bands 160 to 10 meters with a band spectrum scope that displays signals in a 50/100/200KHz range of operating frequency. The multi-function 5" CRT screen displays frequencies, modes, memory contents, operating notes, RIT, two menu screens and subdisplays for packet and RTTY.

And what else? Dual band watch; twin passband tuning; 99 tunable memories; all wide and narrow filters; direct keyboard entry; 150 Watt output; built-in power supply; dual noise blanker; five multi-function timers; two internal clocks and all the standards you can think of.

For pricing and additional information, contact ICOM at 1777 Phoenix Parkway, Suite 201, Atlanta GA 30349 (404/991-6327).



The 21-Day Novice Course from Gordon West Radio School.

21-DAY NOVICE COURSE

Thirty prominent amateur radio equipment manufacturers and accessory suppliers, plus five amateur radio dealers, are taking part in the Gordon West School Novice welcome package. Their literature sheets, rebate coupons, and in-store discount offers are included with every 21-day Novice course sent out to home study mail order students.

The Gordon West 21-day Novice course includes two stereo code-learning cassettes plus the West 112-page Novice book. Also included is the FCC Form 610, a reference chart, laminated world map, and a sample Novice exam package. Everything is included for the Novice exam package to pass the test as well as learn more about all of the exciting ham radio equipment and accessories available for their new hobby.

The 21-day Novice course with all literature and rebates is $22.50 including postage.

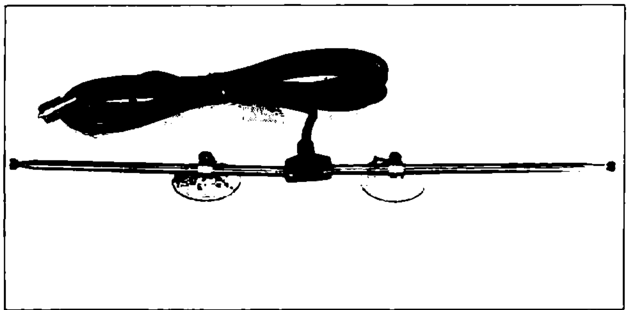
For more information, write Gordon West Radio School, 2141 College Drive, Costa Mesa CA 92626. Or circle Reader Service 201.

ELECTRON PROCESSING

The new Vak-Tenna is the ideal antenna for apartments, offices, travelers and mobiles. Receive coverage from 30-500 MHz includes fire, police, aviation, FM TV, amateur, business, VHF Lo/Hi, and marine. The transmit coverage from 70-230 MHz with 1.5:1 VSWR at 50 Ohms and power levels up to 50 Watts. The Vak-Tenna contains two telescoping antenna elements that together extend to a maximum of 79" and collapse to 20".

There are two powerful section cups that hold the antenna to any smooth surface for weeks. A 15' length of RG-58U coax cable is provided with either a BNC, PL-259, Motorola or F connector for connection to your equipment. The Vak-Tenna is only $30.

More information is available from Electron Processing, Inc., P.O. Box 708, Medford NY 11763; 516-764-9798. Or circle Reader Service number 202.



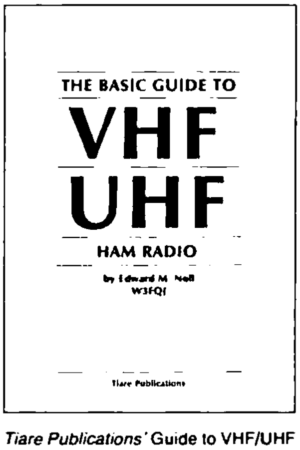
Vak-Tenna from Electron Processing

TIARE PUBLICATIONS

The Basic Guide to VHF/UHF Ham Radio has just been published by Tiare Publications. It was written by ham radio and technical writer Edward M. Knoll W3FQJ.

This new volume provides a down-to-earth basic introduction to amateur radio operating on the 2, 6 and 1.25 meter bands as well as 23, 33 and 70CM. The book presents a clear and easily understood look at VHF/UHF equipment, antennas, operating techniques, repeaters, contesting and awards. Band plans for each of the VHF/UHF bands are also included. The Basic Guide to VHF/UHF Ham Radio, by Edward M. Noll W3FQJ, is available from Tiare Publications for $8 including postage.

More information is available from Tiare Publications, P.O. Box 493, Lake Geneva WI 53147. Or circle Reader Service number 203.



Tiare Publications' Guide to VHF/UHF Ham Radio.

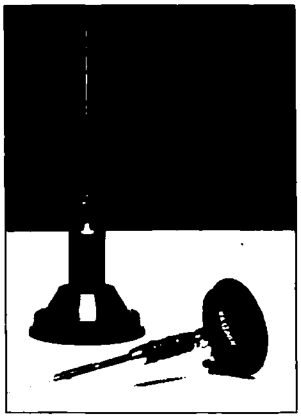
HUSTLER, INC.

Hustler is proud to announce the development of two new series of magnetic mount antennas. Rated at 100 Watts, the RX series (pictured horizontally) consists of a ⅝ wave, 3.4 dB antenna on a magnet mount which holds at speeds to 75 MPH. The RX-2 (2 meters) and the RX-220 (220 MHz) are chrome with a black

mount and coil cover. Both models carry a suggested list price of $20. The RX series is available in all-black versions, models RX-2B and RX-220B, each of which have a list price of $25.

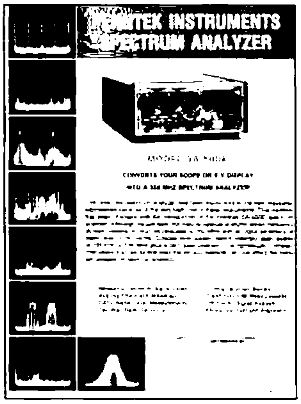
The FX series (pictured upright) is rated at 200 Watts and consists of a ⅝ wave, 3.4 dB antenna on a heavy-duty magnet mount which holds at speeds in excess of 100 MPH. The FX-2 (2 meters) and the FX-220 (220 MHz) have a list price of $25 each. All black versions of the FX series are available as models FX-2B and FX-220B with a suggested list price of $30 each.

For more information on these products, contact Hustler, Inc., One New-Tronics Place, Mineral Wells TX 76067; 817-325-1386.



Hustler offers two new antennas.

Or circle Reader Service number 204.



Penntek Instruments introduces its Spectrum Analyzer.

PENNTEK INSTRUMENTS

Penntek Instruments announces the introduction of its new SA-500E 550 MHz Spectrum Analyzer. When connected to your X-Y display or oscilloscope, this instrument allows frequency domain signal viewing with an on-screen dynamic range of 70 dB. The display center frequency is adjustable from 1 to 550 MHz and is shown on the front panel digital meter. A precision 70 dB front panel RF input step-attenuator is included as a crystal-controlled frequency marker at 5 and 50 MHz intervals. It can be used for measuring harmonic signal levels, finding spurious signals, CATV signal level measurements, off-the-air signal analysis, production test and alignment, and two-way radio servicing. The price is $1,495, delivery stock to 3 weeks.

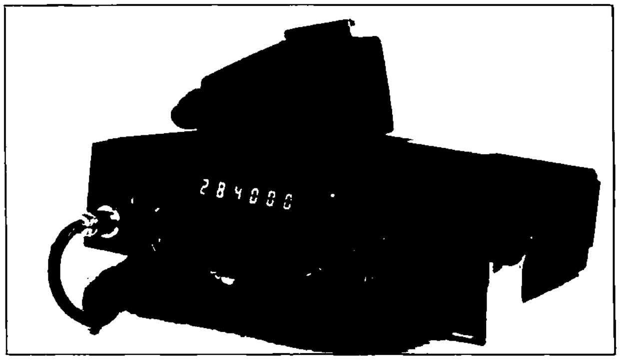
Write or call Penntek Instruments, 14 Peace Drive, Lewistown PA 17044 (717-248-2507) for more information. Or circle Reader Service number 205.

MFJ ENTERPRISES

MFJ Enterprises announces its new MFJ-1278 Multi-mode Data Controller that lets you work seven digital modes: Packet, ASCII, RTTY, CW, WEFAX, SSTV, and contest memory keyer modes. The MFJ-1278 retails for $250. It features high performance HF/VHF/CW modems software selectable dual radio ports, precision tuning indicator, 32K RAM and an AC power supply. Not included is a Starter Pack to get MFJ1278 users on the air instantly. The Starter Pack includes computer interface cable, terminal software and friendly instructions. It is available for the Commodore 64/128, VIC-20 (MFJ-1282, disk; MFJ-1283, tape) and for the IBM or compatible (MFJ-1284), for $20 each. The MFJ-1278 comes with MFJ's unsurpassed double guarantee. If ordered from MFJ, it may be returned within 30 days for a full refund, less shipping. MFJ also backs this product with a one-year unconditional guarantee.

For additional information on all these products contact: MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; 800-647-1800, or 601-323-5869, or Telex 53-4590 MFJSTKV. Or circle Reader Service number 206.

MFJ's data controller.



Clear Channel's mobile transceiver.

CLEAR CHANNEL CORP.

Clear Channel Corp. would like to introduce their new AR-3500 all-mode mobile transceiver. It is loaded with 20 features, some of which are memory switch, LED frequency display, mode display, split program switch for repeater offsets, and many more. The frequency range for transmitting and receiving is 28.0000-29.9999 MHz. There are two different models, the 30 watt and the 100 watt. The 30 watt's suggested retail price is $319, and the 100 watt is only $409. These products are available in-stock.

Contact RF Parts Co., 1320 Grand, San Marcos CA 92069; 619-744-0728 or circle Reader Service number 208 for more information.

Number 19 on your Feedback Card

PART II OF A FOUR PART SERIES

DRIFTING ALONG THE TELEGRAPH TRAIL

Memoirs of a Former Telegrapher

BY DR. WILLIAM C. HESS, W6CK

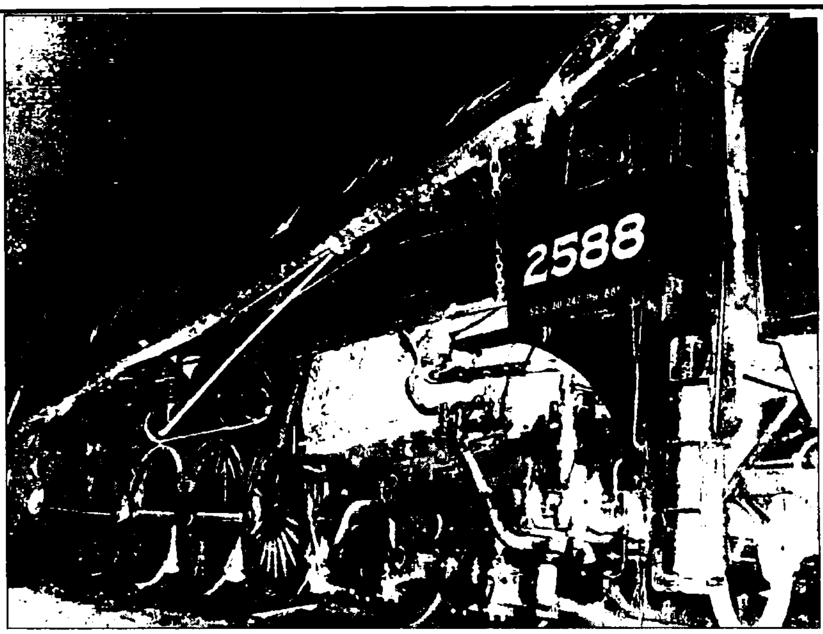


Photo A. The site is a North Dakota village in 1945. The 200-ton Empire Builder crashed into the rear of the observation car, Peoria, whose shell is pictured astride the locomotive. The tragedy was front-page news world-wide. (Photos courtesy of The Fargo Forum)

I would guess that the telegraph traffic during a whole month in Michigan City in 1945 consisted of not more than ten telegrams sent and ten telegrams received. The astonishing increase one August evening in telegraph traffic from Michigan City was due to a disaster. The second section of the posh *Empire Builder* train crashed into the rear of the first section of that train at seventy miles per hour, right in front of the depot at Michigan City. Thirty-four persons who were occupying the observation car and rear sleeping car of the first section were killed.

The aged gentleman who was the station agent at the site of the disaster sent telegrams all night until 8 AM the next morning. At the ten percent commission allowed him by Western Union for all messages originating at his station, he earned $125 in one night—equal to a month's salary.

During the night, he was "spelled" occasionally by another railroad telegrapher from a nearby town and by a US Navy radio operator—a train passenger who happened to be proficient in both American and International Morse code.

From Tragedy to Comedy

That was a tragedy. Yet, to use an old cliche, my career in telegraphy ran the gamut from the ridiculous to the sublime. At the Western Union office in Torrance, California, I was on duty when a gentleman arrived bearing a large bouquet of flowers picked from his own garden. This was an economy move designed to eliminate the fees charged by the florists in Torrance who were members of the florist's telegraph delivery system. He requested that we telegraph said flowers to his mother in a distant city.

To further reduce the cost of sending flowers to his mother as a Mother's Day gift, he told me: "Look, today is only Saturday and Mother's Day is not until tomorrow, so just send these to her via *Night Letter,*" whereupon he handed me the bouquet. (For the benefit of younger readers who may not be familiar with Western Union's operations, Night Letters were much cheaper than regular telegrams and were not delivered until the morning following the day they were sent.)

The Torrance office was also the site of what I call the "snatch-back maneuver." Obviously, when accepting a telegram for transmission, the Western Union clerk must count the number of words in the message, check for misspelled words, and check to see that the sender's name, address and telephone number are included on the telegram so that he may be contacted if there is difficulty in delivering the message.

When I picked up a message filed by one Torrance customer to check it, he immediately snatched it back and said, "Oh, I don't want you to *read* it; this message is *private.*"

At the National City Western Union office, immediately adjacent to the huge San Diego Naval Base, a young sailor appeared on a Friday and requested that we immediately have his mother in Atlanta telegraph his baseball uniform to him in time for the big Navy intramural baseball game which was to be played the next day.

I explained to the young man that draping the uniform over the telegraph wire in Atlanta would be no problem at all for us to accomplish and that applying a jolt of electricity to the wire to send the uniform on its way to the West could also be easily done. The problem, I explained patiently, would be that the uniform as it slid along the wire, would soon encounter the wooden crossarms which hold the insulators necessary on every telegraph pole and thus be hopelessly snagged by one of these wooden obstacles. He became quite hostile, not because of my explanation, but rather because he said he knew damn well that flowers and boxes of candy—which were just as large as his folded baseball suit would be—were sent by telegraph all over the United States every day. And what's more, the only reason I wasn't helping him solve his problem was because I didn't *want* to do so.

To many a housewife or person who rarely or perhaps never received a telegram, the yellow telegram envelope with its glassine window displaying the name and address of the addressee on the telegram within is a symbol of only one thing: death. The shocked expression and the sudden absence of facial color are common to persons who rarely receive a telegram. In cases involving delivery of telegrams to housewives, the lady signing for the telegram is very often afraid to open it. She places it on the dining room table until her husband returns from work. Such action, of course, defeats one of the main advantages of a telegram: speed.

On numerous occasions during my telegraphy career, I have sent telegrams to a distant city for a customer and received a reply while he waited, all within fifteen minutes.

(Part 3 of the series will follow next month.)

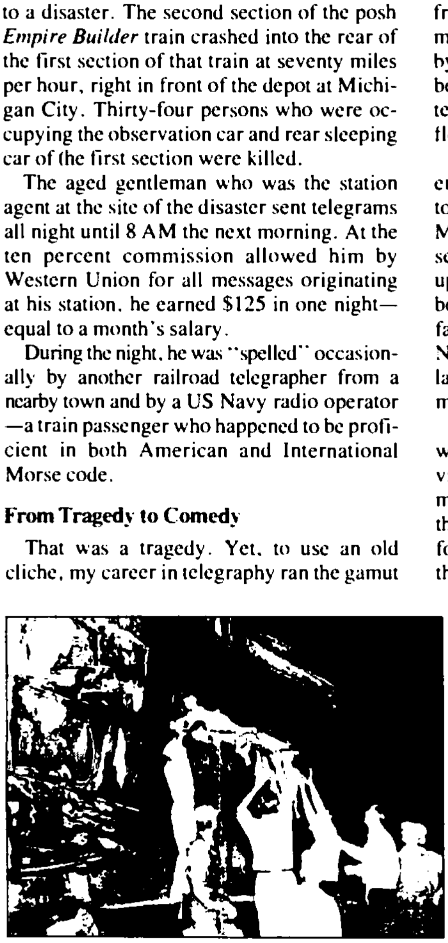


Photo B. The Michigan City wreck required that welders use cutting torches to remove the steel panels from the sides of this Pullman car to free survivors.

Dr. William C. Hess, W6CK, lives in Pasadena CA (PO Box 19/M). He presided over the North Dakota depot of Woburn, a tiny village in North Dakota, from 1937 through 1942.

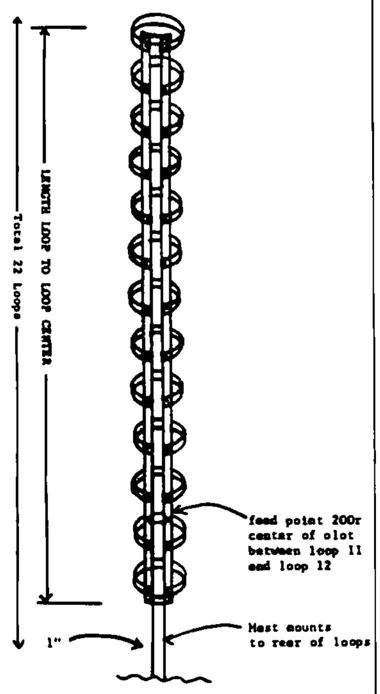
ATV

Number 20 on your Feedback card

Ham Television

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

In several years of polled studies the USATVS (Untied States Amateur Television Society) verified that most of the country uses horizontal polarization for the Fast Scan TV UHF mode. Nearly all of the Midwest, from the Rockies to the Great Plains States, and eastward to the Atlantic states utilize H-plane (horizontal) radiation patterns. There are a few exceptions in Omaha, Cedar Rapids, and Indianapolis. Omaha's system uses commercial decibel product gain antennas at the 600 foot level of a broadcast TV/Radio tower. Ice and wind conditions would just not allow much less than a commercially built, rugged antenna. Other areas, however, in similar situations using a highly elevated antenna array, have indeed found a horizontal solution and beating ole' man winter with slotted antennas.



Calibrated (ref. ¼ wave diapole)
Measured Test Results:

Slot side	7 dbd
Back side	6 dbd
Sides	4 dbd

Figure 1. This Rib Cage slotted antenna design offers nearly true omnidirectional, horizontal polarization with 5-7 dBd gain.

Parts of Florida, some areas of Texas and nearly all of California use vertical polarization. This varying local choice standard is best illustrated on pages 18 and 19 of the USATVS's new North American ATV Directory Guide ($5.95) booklet #101.

For many years, many believed that true omnidirectional, horizontally polarized antennas with gain were unobtainable. Everyone has experimented with or at least heard of Big Wheels, Halos, Squalos, and Crossed Dipoles. Even though these antennas do indeed radiate in the H-plane, they lack sufficient gain to get out very well. The best answer in the past seemed to be "stacking a set of four Big Wheels" for about 4 to 5 dBd of gain. That is, until Merle Reynolds W9DNT of Moline, Illinois (Iowa BRATS ATV Group) and Gerald Cromer K4NHN of Cayce, South Carolina, (Palmetto ATV Group) began reading, learning, re-designing and experimenting with age-old Alford Slot antennas!

The Spec Com Journal has published numerous articles about W9DNT's and K4NHN's fine work using British designed Alford Slot antenna principles. Merle and Gerald had to dig out a lot of hard to find facts about these antennas, which were designed for use above 1000 MHz. The trick was to get them to work down on the 70 cm band where most of the Fast Scan TV signals are located.

Gerald Cromer K4NHN built the " Rib Cage Slot" (Figure 1). K4NHN and WA4UMU both report that this design produces a measured 5-7 dBd of gain and radiates a semi-true horizontally polarized pattern. The pattern has slightly stronger front and back lobes, which may actually prove advantageous in some areas. The unwanted directivity is possibly caused by a slightly too small radiating element circumference.

They have two of these antennas running on the Sumter, South Carolina, ATV/R system. The antennas perform very well with coverage well over 40 miles in all directions—not bad for UHF-TV! Other groups in Pennsylvannia, New York, and Connecticut have adopted the Rib Cage design.

W9DNT chose to experiment with the simple and original Alford Slot design. Using 3- to 4-inch round gutter or stove pipe tinned iron material. Merle developed a design for the 420-440 MHz band. A serious technical construction building article was published 2½ years ago in the July 1985, Volume 15, No. 5 issue of Spec Com by W9DNT. Additional updated information on better working, later model designs was recently published a couple months ago in the January 1988 issue. His latest version, a two-element phased, Dual-Slot antenna is shown in Figure 2.

Although his antenna has yet to be officially measured at a VHF/UHF conference, a conservative estimate gives it 5-6 dBd of gain when compared to a single known 7.8 dBd KLM-440-6 beam antenna. It is very omni! The pattern has a slight noticeable minor dip at the back side of the slot opening.

In figure 2, note the ¼ wavelength, 75 to 50 ohm "Q" section match, which is used for the phasing harness. It is fed directly at the center of the slot openings 28 inches from top and bottom. The overall length of the entire antenna is 116 inches. Yes, it is big and tall and a bit awkward, but it works! The BRATS ATV Club's N9CAI ATV/R system in Davenport uses two of these antennas, one for receive and one for transmit. W9DNT found that 3, 3½ or 4 inch stock may be used. A ½ inch slot opening is required for smaller circumference designs and a ¾ inch opening works best for the 4 inch model. A ⅜ to ½ wavelength cut maintains true omni patterns, and any more or less than that causes directional lobes.

The standard formula of 246 (¼ WL) divided by f (frequency in MHz) = amount in feet multiplied by 12 (inches) times the 75 ohm stubs' coaxial velocity factor (either .79 or .66) is used to calculate the phasing harness length. Figure 3 deplicts the final harness arrangement. This harness is taped, sealed and fastened inside the slot antenna housing itself. A type "N" connector is brought out for the main feed line connection point. Note that the lengths of the ohm stubs are not very critical

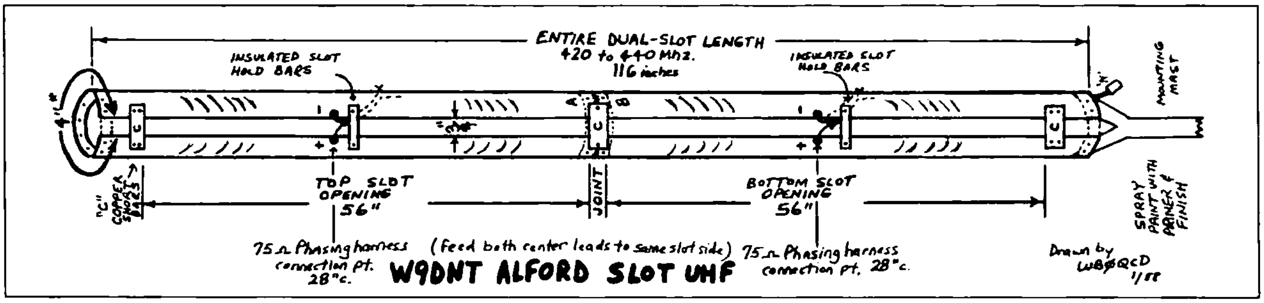


Figure 2. The W9DNT Dual-Slot antenna is easy to build from 3- to 4-inch stove pipe. It consists of two phased, stacked elements.

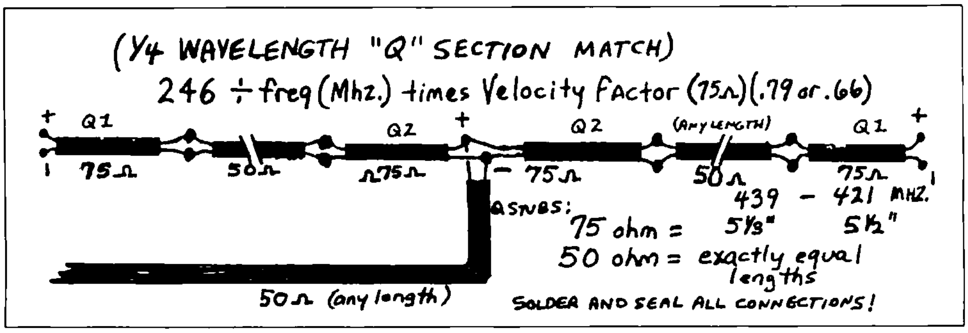


Figure 3. Details of the Q-section impedance match for W9DNT's Dual-Slot antenna.

(5 1/3 to 5 1/2 inches). The sections of 50 ohm feed can be of any length, but they must be equal to each other.

Once securely mounted, W9DNT's Dual-Slot is as rugged as any commercial antenna and performs very well.

Contact Merle and Gerald for more information. W9DNT's phone number is 309-764-1685 (afternoon and no later than 10 PM).

Gerald, by the way, is a regular on the Tuesday night ATV Users HF Network and you can talk with him or Hap WA4UMU about their designs directly. No longer can anyone say, "It can't be done." Getting the majority of the country back on the same polarization will ease existing incompatibility standard problems in many areas. Now ATV'ers can have their cake (ATV Repeaters) and set it (horizontally polarization and DX) too!

75 and 20 Meter Ham-TV Nets

The new 75 Meter 3.860 (plus 5-10 kHz) Tuesday night USATVS ATV Users Net has been in full swing for several months now! Three Net "shifts" have been established. Bill Brown WB8ELK in Findlay, Ohio, sets the established operating frequency and calls the "Early Bird" portion promptly at 8 PM (Eastern time). Hap Griffin WA4UMU of Sumter, South Carolina, takes over at 9 PM followed by yours truly WB0QCD at 10 PM. Nearly 40 net member stations check in from all parts of the country each week! Stations can be heard from New York and Pennsylvania down to the Carolinas and Virginias, over to Texas, throughout the upper Midwest and to Missouri, Nebraska, and Minnestoa to the west. Even some California stations have tried to check-in! It is just great to hear all the progress everyone is making and interest being stirred about the Ham-TV modes across the USA! Tune-in next Tuesday and say hello!

An amateur radio FAX Users Net has been established by KC0OR on Sunday afternoon at 2 PM. He should meet at 14.245 MHz where FAX operation has been suggested. A devoted SSTV'er, he is holding his nets around 14.233 MHz. Unfortunately, KC0OR ignores the League's 1987 Handbook listing, the USATVS Journal's and AEA's published 14.245 MHz recommendations. The important thing is for you FAX nuts to get together somewhere and get the hi-res mode going on transmit as well as just receiving weather pictures.

AEA's new PK-232 software package call PK-FAX is going to revolutionize FAX computer on-the-air transmissions. I will try to be on 14.245 MHz on Sundays for those of you who want to play computer FAX and exchange pictures. Don't just sit there and listen to the DX'ers. Identify and put your tones on! It will attract and demand attention!

The W1JKF/W9NTP American SSTV Users Net is still growing strong on 14.230 MHz every Saturday afternoon at 1 PM (Eastern). Brooks and Don are very conscious of 8-second, black/white, ROBOT 400 operators and replay 12-36 second color pictures in the lower resolution formats quite often. The attempt by the ailing I.V.C.A. SSTV Group to move the 14.230 MHz SSTV calling frequency to a higher spot on 20 meters failed, as it had done once before a few years ago. The DX threatens 14.230 MHz, since SSTVers are losing strength. We need to nationally publicized and declare Month of SSTV and FSTV. Now ten meters is hot again and 28.680 MHz hasn't seen too many SSTV pictures. A few years ago everybody lived on that frequency! Let's QSY and use it as well.

The USATVS sent out nearly 100 six-page letters to UHF frequency coordinators introducing them to the FSTV signal and its' characteristics, what interference can do to ATV pictures, and how intelligent frequency coordinating must be conducted for the protection of the Ham-TV modes against other users of the band. So far, we have seen fair response to our efforts. If you would like to see a copy of this correspondence and are having troubles with QRM interference, send a SASE. There is also a new QRM Interference Complaint Registration Form #2000 available (See January 1988 Spec-Com).

Don't forget to stop by and log-in to the upcoming Dayton Hamvention "ATV Workshop" sessions Friday and Saturday nights (7-11 PM) at the Ramada Inn North (I-70 and I-75). Come early to get a good seat! Bring your VCR demo tapes and photographs, too. The Dayton ATV talk channel is 147.450 MHz simplex.

Photo A. Gerald Cromer K4NHN, inventor of the Rib Cage Slot, makes his point.

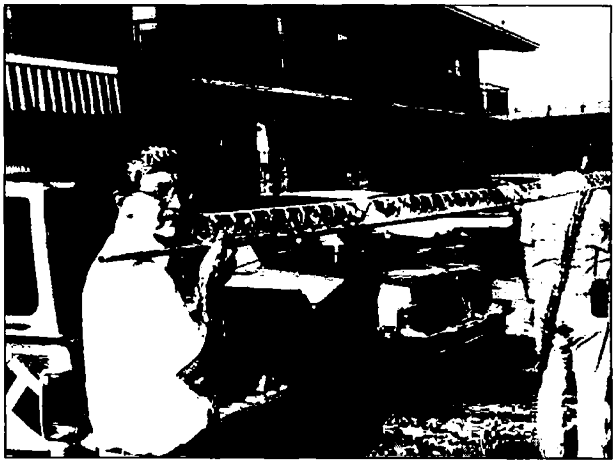


Photo B. K4NHN (left) and N4JUR show off their Rib Cage at Dayton '87.

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Xerox MemoryWriter—parts, assemblies, boards, manuals. Free help with service problems. W6NTH, Box 250, Benton AR 72015 501-776-0920. BNB404

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by Jim Gray W1XU

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JAPAN	14	14	14B	7B	7B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7A	7	7	7	7	14	14	14	14A	14
PHILIPPINES	14	14	14B	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14	14	7A	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	14	14	14	14A	14A	14	14
U.S.S.R.	7A	7	7	7	7	7B	14	14	14A	14A	14	14
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AUSTRALIA	21	14	7A	7B	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	21	14	7A	7	7	7	7A	14	14	14A	21A	21
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PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	7B	14	14	14	14A	14	14
U.S.S.R.	7A	7	7	7	7	7B	14B	14	14A	14	14	14

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ARGENTINA	21	14A	14	14	7	7	7	14	21	21A	21A	21
AUSTRALIA	21A	14A	14	14	7A	7A	7	7	7	7B	14	21
CANAL ZONE	21	14	7A	7	7	7	7A	14	14	14	21A	21
ENGLAND	14	7A	7	7	7	7	7B	7A	14	14	14	14
HAWAII	21A	14A	14	14	7A	7	7	7	14	14	21	21
INDIA	14	14	14	7A	7B	7B	7B	7A	14	14	14	14
JAPAN	14A	14A	14	14	14B	7B	7B	7B	14B	14	14	14
MEXICO	14	14	7A	7	7	7	7	14	14	14	14A	14A
PHILIPPINES	14A	14	14	14	14B	7B	7B	14B	14	14	14	14
PUERTO RICO	14A	14	7A	7	7	7	7	14	14	14	14A	14A
SOUTH AFRICA	7	7	7	7	7B	7B	7B	14	14	14A	14	14
U.S.S.R.	7B	7B	7	7	7	7	7B	14B	14	14	14	14
EAST COAST	14A	14A	14	7	7	7	7	14	14	14	14A	14A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
# = Chance of aurora.
NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST

PROPAGATION FORECASTS—March 1988

Readers have shown increasing interest in radio propagation forecasting, so 73 has asked me to expound on my method of radio propagation prediction.

I prepare the forecasts approximately two months in advance in order to meet deadlines. The government provides a summary of past data for the previous week or so and also gives an estimate of expected solar behavior for the coming month. Although they give past data in great detail with much information about the sun and earth, future estimates are very general. Indeed, they have to be. Ionospheric propagation forecasting is empirical, not exact. Future trends are estimated based on thousands of past observations plus some new material developed independently and used in concert with previous data, and my crystal ball, reserve the right to be wrong on occasion.

MARCH

SUN	MON	TUE	WED	THU	FRI	SAT
		1 P–F	2 F	3 F	4 F–G	5 G
6 G	7 G	8 G	9 G	10 G–F	11 F	12 F–G
13 G	14 G–F	15 F–P	16 P	17 P	18 P	19 P
20 P	21 P–F	22 F	23 P–F	24 P–F	25 F–G	26 G
27 G	28 G	29 G	30 G	31 G		

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Continued from page 59

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AERIAL VIEW

Antenna News

Arliss Thompson W7XU
7314 SW 28th Avenue
Portland, OR 97219

Handy Yagi

Rubber ducky antennas are great, aren't they? Small and compact, they only require a couple of watts from your HT on your favorite repeater frequency, and you're in business. Unless, of course, you happen to be in a fringe area where repeater coverage is marginal. Then you may find that your signal into the repeater is inadequate to maintain reliable communications.

One possible solution is to switch to higher power, but doing so increases battery drain and, unless you have a preamp, does nothing for your receive capabilities. A longer antenna that mounts directly on your HT, such as a ½- or ⅝-wavelength antenna, can do wonders on both transmit and receive, but may still prove inadequate under some circumstances.

For instance, while I'm no mountain climber, I do enjoy day and weekend hikes to hilltops, and I like to carry my 2m handheld along with me on those excursions. Frequently I hike in fairly remote areas, and although the higher elevation of a hilltop certainly extends the range of the HT, an antenna with some gain and directivity can provide a notable increase in range.

Also, the gain can give an increase in operating time (using low rather than high power), while the directivity decreases the likelihood of bringing up two or more repeaters on the same frequency simultaneously. The antenna I use in such situations is a lightweight, 3-element Yagi that takes up a minimum of space when disassembled, yet can be readied for use in less than two minutes. It provides 6 to 7 db gain over a ½-wave dipole. Gain over a typical rubber duck is about 12 db. Read on and I'll show how to build one.

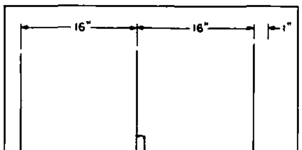


Fig. 1. Dimensions for 3-element Yagi designed for portable use on the 2-meter FM band.

Design Points

Let's first discuss the design objectives for this project, namely:

1) Good gain and directivity;
2) Light weight and compact;
3) Self-supporting;
4) Rapid assembly and disassembly;
5) Simple matching to 50-ohm coax;
6) Ready availability of materials; and
7) Easily duplicated with hand tools.

After considering a variety of possible antennas, including quads, V-beams, and other wire antennas, I settled on the 3-element Yagi mentioned above and described below. I'll leave it to you to decide how well it meets the above criteria.

Construction

Figure 1 shows the antenna in schematic form. Studying the diagrams and the photos will help the builder understand how to construct the antenna (this is another picture worth a thousand words). As for tools, I used nothing fancier than a hacksaw, a hand drill, two taps and a die. I'll admit that a drill press would make alignment of the various holes considerably easier, but this design can be replicated without much difficulty.

One of the difficulties in building a portable yagi is in how to mount the elements so that the antenna can be easily assembled and disassembled. I solved the problem by using a die to thread a portion of the ¼" solid aluminum rods used to make the elements. Assembly merely involves screwing each element half into the boom, a quick and easy procedure.

This method of mounting the elements will not work with a thin-walled hollow boom. Since a boom made of solid rod would be quite heavy, I choose to use aluminum tubing with solid rod inserts in the three areas where the elements are mounted. The boom is made from ¾" diameter, .055" wall thickness, aluminum tubing, with short lengths of ⅝" diameter solid aluminum rod serving as the inserts. The inserts are tapped both for the elements and for the 6-32 machine screws that hold them permanently in place (see Figures 2 and 3). All of these materials were purchased at the local discount building supply store.

To keep the maximum length of any portion of the disassembled antenna less than 20 inches, I cut the boom into two sections. The solid rod insert into which the driven element mounts protrudes ¾-inch from the end of the first of those sections. During assembly, the two pieces of the boom are aligned by fitting the second section of boom over the rod insert that extends from the other section. The sections are then held secure by screwing the driven element into place. See Figure 2.

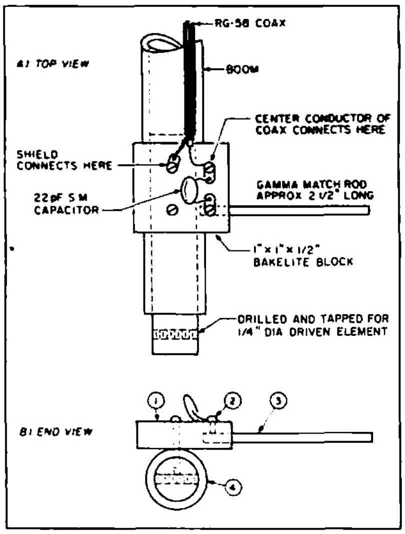


Fig. 3. Details of gamma match construction as viewed from (a) above, and (b) end on.

> **"As a Soviet acquaintance once phrased it, 'to make talking'. . . takes less than two minutes."**

*Another problem to overcome when building a portable yagi is the method of feeding the antenna. I needed a matching method that would work without having to insulate the driven element from the boom, and I hoped I wouldn't have to employ a balun. Therefore, I opted for the gamma match. The gamma rod, like the elements, is made of 1/4" diameter aluminum rod. It, too, is threaded, and screws into a 1" x 1" x ½" block of bakelite (or similar insu*lating material) that is mounted on the boom (Figure 3). The gamma capacitor is a 22 pF silver mica unit also mounted on the bakelite.

Figure 3 illustrates when the gamma rod is screwed fully into its mounting block it seats against a 6-32 machine screw situated at right angles to the rod. This pro-

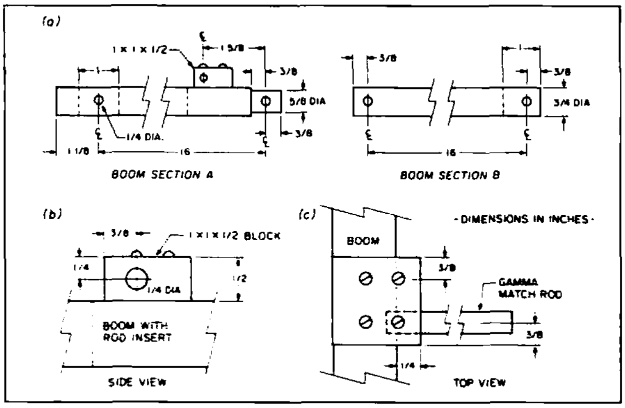


Fig. 2. Details of (a) boom, and (b and c) gamma match construction for the portable antenna.

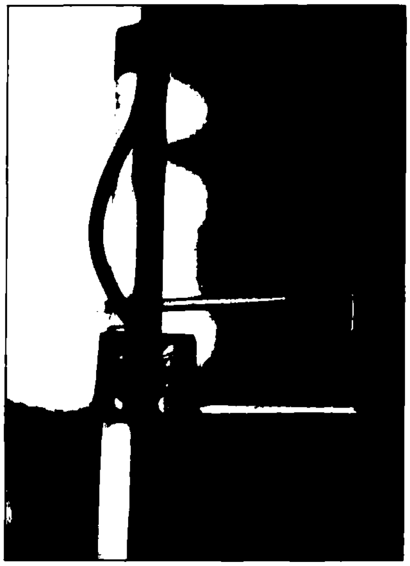


Photo A. Close-up of gamma-match assembly.

vides the necessary contact for its transmission line end. The attachment of the gamma rod to the driven element must provide good contact yet be readily assembled and disassembled. I made the connection by soldering two one-inch alligator clips end to end, as shown in Photo A.

The design criteria required the antenna to be self-supporting. The boom and elements of this antenna are obviously self-supporting, but how about the antenna as a whole? Although the antenna is lightweight, it's rather a nuisance to have to hand-hold the antenna at the midpoint of the boom while operating. Also, holding the antenna in this manner is apt to upset its pattern and adversely affect the gamma match.

To overcome this the boom extends 1″ behind the reflector. One end of a ½″ PVC tee coupling provides a somewhat loose but adequate fit when placed over the boom extension, with a length of ½″ schedule 40 PVC pipe also fitting into the tee and serving as a mast. I used a tee rather than a 90-degree elbow, because it allowed me to use a short piece of PVC as a "handle" for the yagi (Photo B). The mast, of course, can be made from several sections of pipe using PVC couplings.

Tune Up

Tuning is simple and straightforward. Due to inevitable variations that will occur between your antenna and mine, I can only give approximate dimensions for the gamma match. However, it should be possible to compensate for any unit to unit differences by changing the position on the two alligator clips that form the gamma rod to driven element short. With the gamma rod spaced 1¾″ from the driven element, and using a 22 pF gamma capacitor, I acheived a 1.1:1 SWR at 146.5 MHz with the shorting rod spaced 2¾″ from the centerline of the boom.

To optimize the match between the antenna and its feedline, start with a gamma rod approximately 3″ long. With the antenna in the clear and the shorting clips positioned at the end of gamma rod, measure the SWR (using only enough power to provide adequate meter deflection) at 146.5 MHz. The SWR will probably be greater than 2:1. Now in a series of ¼-inch steps, move the shorting clips closer to the boom, checking the SWR after each change of position. The SWR should be better than 1.5:1 SWR.

In the unlikely event that a satisfactory match is not obtainable, make sure the gamma rod is seated against the machine screw that serves as its contact. If that does not solve the problem, try making small changes in the value of the 22 pF gamma match capacitor.

Once a good match is obtained, either mark the correct location for placement of the short with paint or tape, or trim the gamma rod in length so a good match is achieved by placing the short at the end of the rod. See Photo A.

In the Field

Setting up the antenna in the field is very straightforward. I prefer first to align the two sections of the boom and lock them in place by screwing the two halves of the driven element into their respective holes. I then assemble the director and reflector. To avoid any confusion, I have marked the elements with small strips of tape.

With a narrow strip of tape around the boom at the director end, I know that the two element sections with a narrow strip of tape around each form the director. The elements with the wide band of tape are for the reflector, and the reflector end of the boom is similarly marked. No tape signifies the driven element. Color coding with tape or paint is another possible means of identifing the elements.

Once the elements are assembled on the boom, I screw in the gamma rod and attach the shorting clips. Then the mast is attached, the feedline connected to the radio, and I'm ready, as a Soviet acquaintance once phrased it, to "make talking." From start to finish takes less than 2 minutes, and disassembly is just as easy. By the way, I suggest a cloth or canvas bag for carrying and storing the antenna.

"This design can be replicated without much difficulty."

Variations

The design of this antenna is based on information contained in the National Bureau of Standards Technical Note 688, as it appeared in the August 1982 issue of QST. That article provided a number of design curves allowing the antenna builder to arrive at the proper element lengths for a given frequency, element diameter, and boom diameter. Note the dimensions are based on a element mounting method that has the elements running through the boom.

Mounting the elements of above the boom or insulating the elements from the boom will probably not give a maximum gain antenna. This also applies to the dimensions provided here. Sure, the antenna may work with these dimensions and a different method of mounting the elements, but performance will probably be less than optimal. The moral here is for hassle-free contruction, do not deviate from the dimensions provided.

On the other hand, feel free to experiment. For example, I built another version of this antenna using 3.16″ aluminum welding rod for elements and had good results, although the driven element and reflector lengths were each approximately ⅛″ longer than when the larger diameter material mentioned above was used. I could only find the welding rod in 36″ lengths so I had to purchase six rods to build the antenna, but at only 50 cents per rod the price was right. The welding rod was softer and more subject to bending than the heavier ¼″ rod I used in the version described here. Since the antenna gets some rough treatment at times, I prefer the larger diameter material in this application.

That's it. For some other ideas on portable 2m gain antennas check out "Handi-antennas" in May 1983, Ham Radio, p.42, and "A portable quad for 2 meters," September 1980 QST, p.26 (with follow-up comments in June 1981 QST, p.39).

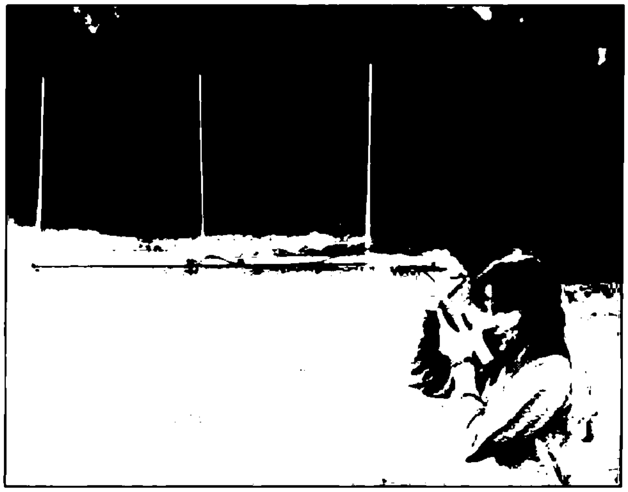


Photo B. The assembled portable Yagi in action.

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
2310 Romayor Court
Pearland TX 77581

AMSAT OSCAR 10

AMSAT-OSCAR-10 is once again into a season of declining sun angles. This means satellite chasing in the coming months won't include OSCAR-10's high orbit. However, unlike previous hibernation periods, satellite chasers can now look forward to the Phase 3C launch as an outlet for new satellite projects, antenna building, and equipment upgrading.

Phase 3C may be launched as early as this month. Time is running out to make station improvements.

Unlike most other hamsats, a Phase 3-series satellite will not be released for immediate use following launch from the Kourou Space Center. Observers need to first monitor and document satellite orbit and orientation. Then they can calculate the burn sequence necessary to inject the satellite into its final orbit. AMSAT engineers will send the orbital correction commands to the IHU (Integrated Housekeeping Unit, the computer on Phase 3C), which will execute them at the appropriate times.

How long will this take? Perhaps four weeks. AO-10 needed seven weeks, but conditions were different. AO-10 was the first Phase 3 spacecraft to achieve orbit. It was the most ambitious and complex amateur radio satellite at the time. The satellite launch team could draw from no previous experiences. The engineers had to insure the liquid-fueled kick motor worked properly since two separate burns were planned. To add to the challenge, after deployment from the launcher canister, the satellite spun in the wrong direction and suffered from low power because its solar panels were at a bad angle relative to the sun.

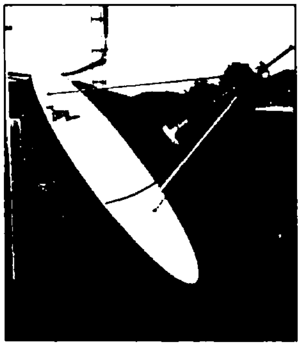


Photo A. Six-foot TVRO system with separate azimuth and elevation control.

Is a kick motor really needed? When the Ariane upper stage deploys Phase 3C, the satellite will be in a geostationary transfer orbit (GTO) with severe limitations. The worst problem is the perigee, or low point of the orbit. The new satellite, if left alone, would last only a few months as atmospheric drag takes its toll. The first burn will correct this by raising the perigee from a few hundred kilometers to above 1000 kilometers. The second engine firing will raise the inclination (the angle of the orbit with respect to the equator) so satellite-chasers in the northern hemisphere can have better access during apogee (the orbit's highest point).

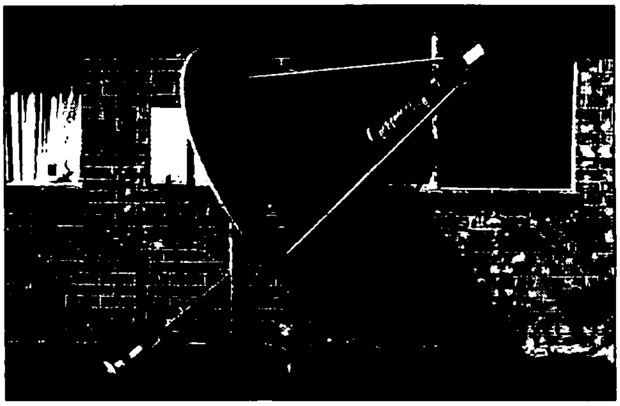


Photo B. Six-foot TVRO system with 1296 MHz "Coffee-can" feedhorn on six-foot dish.

AO-10's inclination correction burn didn't occur. The first firing spent all the fuel due to a wiring error. If all goes well, Phase 3C access time will be much greater than for AO-10. (Those active on AO-10 may find this is hard to imagine.) For some, a correctly-placed Phase 3 spacecraft will give up to 20 hours a day of satellite access.

The reader can find the complete Phase 3C frequency plan in the August, 1987, Hamsats column. Four VHF/UHF bands are used in various combinations to create the various "modes" for satellite operation. Although circular polarization antennas are better for satellite work, a good set of Yagis suffices for two meters or 70 cm. The 23 cm (1269 MHz) and 13 cm (2400 MHz) bands require a higher gain antenna.

Mode L Revisited

Mode L with 1269 MHz up and 436 MHz (435 MHz for Phase 3C) isn't new, but fewer than 100 amateurs worldwide succeeded with this mode via AO-10. Due to a component failure in the L transponder, amateurs needed high-power levels to consistently access the satellite. Although 10 Watts on 1269 MHz to a six-foot dish sufficed on many occasions, it didn't work every time. Most hams didn't have the cash or time to pursue this mode.

Mode L via Phase 3C should be much easier, but inexpensive equipment is still not commonplace. A four-foot dish with a coffee-can feed system and a 10-Watt transmitter should be enough. An ICOM IC-1271A will do this nicely, but with foreign exchange-rate problems, this may not be cost-effective. All one needs is a simple transmitter or transmit converter capable of reasonable output (up to 10 Watts) between 1269.33 and 1269.58 MHz. A viable dish and feed system appears in the 1988 ARRL Handbook in the space communications chapter.

The Quest for Mode S

When Phase 3C is launched, Mode S transponder will use 70

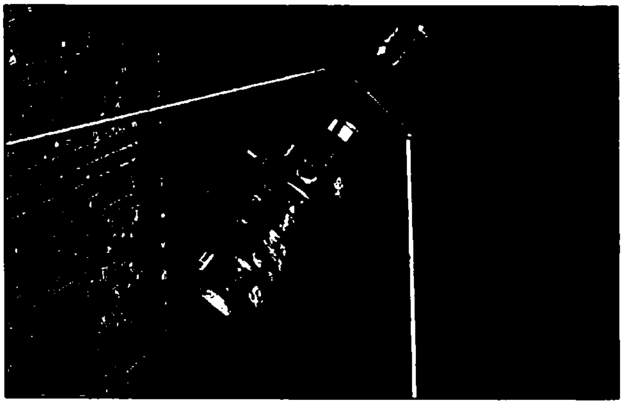


Photo C. Close-up of the coffee-can feedhorn on the six-foot dish.

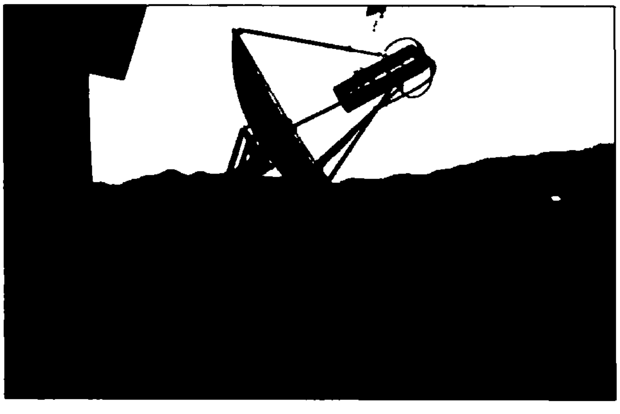


Photo D. Four-foot dish with coffee-can feed for Mode L uplink at W6ABN.

Satellite	Period (minutes)	Long. Increment (deg. W.)
U-O-9	94.12090	23.52732
U-O-11	98.54016	24.63548
F-O-12	115.65347	29.23939
RS-10/11	105.02403	26.38181

Table 1. Orbital data for low-earth orbit hamsats.

cm up and 13 cm down. At first glance, anything using frequencies above 1.3 GHz may appear unreachable. Mode S doesn't need a high-power microwave uplink. Anyone presently operating Mode B using 435 MHz up and 145 MHz down isn't far from mode S via Phase 3C. The uplink requires signals from 435.61 to 435.64 MHz. Power demands will likely be similar to Mode B, 100 to 1000 Watts ERP (Effective Radiated Power). Most antenna manufacturers make excellent crossed Yagis suitable for Mode S uplink. A station running 50 Watts at the transmitter, through 50 feet of Belden 9913 coax to a 10 dB gain antenna will have an ERP of 365 Watts.

For the downlink, a two-meter multi-mode receiver or transceiver can act as the heart of the system. From there, a low-noise receive converter that will transpose 2400 MHz to 144 MHz, and an appropriate antenna, will be necessary. The satellite's beacon will be heard on 2400.64 MHz, thus the two-meter rig would read 144.64 MHz. The transponder passband extends from 2400.695 to 2400.725 MHz.

The easiest way to get on Mode S is to buy everything. Down East Microwave of Troy, Maine, sells loop Yagi systems tuned for Mode S, along with receive converters and mast-mounted preamps. They are perhaps the only outlet offering a receive converter specifically tuned for Mode S reception. It is a modified LMW Electronics unit from England.

Home-brewers can build certain components at home. A four-foot dish with a coffee-can feed works very well used with a GaAsFET preamp. Look to the RSGB (Radio Society of Great Britain) VHF-UHF Manual and the proceedings of the 1986 Central States VHF Society Meeting to learn about using coffee-cans as feedhorns. Other excellent sources of information on 13cm gear include The UHF Compendium edited by DJ9HO, the Proceedings of Microwave Update '87 (ARRL publication) and the "13 Centimeters" column in "QEX" by Bill Olson W3HQT.

2.4 GHz Antenna System and Downconverter

Feedline loss at 2.4 GHz is serious. Locate the dish or other antenna system with the preamplifier as close as possible to the shack with a very short (10 to 20 feet) run of 9913 coax or hardline.

A surplus TVRO (satellite TV) dish is a good candidate for Mode S, but the mount needs to be adjustable in both the azimuth and elevation plane. A coffee-can feed next to an existing C-band TVRO feed works very well. Some stations used their TVRO system for Mode L uplink on AO-10 when they weren't watching locally blacked-out football games via satellite.

Set up the rest of the downconverter system in the shack. A simple converter will have a crystal-controlled local oscillator, perhaps one stage of preamplification and a mixer. Most transverters for 13 cm are designed for operation at 2304 MHz. Since Mode S uses 2400 MHz, system retuning requires a new local oscillator.

Mode S offers a new challenge. I hope to be reporting on the progress of stations here and overseas that have put the pieces together for successful Mode S operation.

More on Tracking

Interest in simple non-computer tracking methods has revived.

A reference orbit is defined as the first orbit of the day (UTC) when the satellite crosses the equator while travelling north. Information would include the date, time, and longitudinal position of this crossing.

Armed with a reference orbit, the satellite's location can be extrapolated using the period (time in minutes for a complete orbit) and the longitude increment (distance in degrees between one crossing point and the next).

SPECIAL EVENTS

Ham Doings Across the Country

Special Events listings will be provided by 73 Magazine *free of charge on a space-available basis. Announcements must be received by us by the first of the month, two months prior to the month in which the event takes place (by March 1, for example, for a May or later event). Please mail to Editorial Offices,* 73 Magazine, *WGE Center, Peterborough NH 03458. ATTN: Special Events*

PLAINWELL MI
MAR 4–6

The Second Annual State Technical Institute Electronics Communications Seminar and Hamfest weekend will be held on March 4, 5 and 6, on the school grounds at 33 Alber Drive. CET and NABER Examinations will be administered on Friday, March 4th Technical seminars will be conducted on Saturday, March 5th.The Hamfest will be from 8 AM to 3 PM. Admission is $2, and tables are $4 and $6. Talk-in on 146.46 Simplex and 224.28/224.66 (State Tech Repeater). Flea market, distributors' displays, VE examinations, campus and Electronics Department tours. For more information and table reservation write to: *Philip Schmitt WA8JXE, State Technical Institute, 33 Alber Drive, Plainwell MI 49080; or call the school at 616-664-4461*.

WASHINGTON TX
MAR 4–6

The Brenham A.R.C. will operate a Special Events Station from Washington-on-the-Brazos State Park Beginning 0000Z March 4 until 0000Z March 6, to commemorate the 152nd Anniversary of the Signing of the Texas Declaration of Independence from Mexico. Frequencies: phone, CW and Packet–VHF, UHF and HF 10 thru 80 meters, including the 10 Meter Novice phone band. For a commemorative QSL, send a legal size SASE to: *BARC, P.O. Box 44, Brenham TX 77833*.

CHICOPEE MA
MAR 6

Mount Tom Amateur Repeater Association Annual Fleamarket will be held Sunday, March 6 at the Knights of Columbus. There will be computer, electronic and Amateur vendors. Tables are $8 in advance, $10 at the door. Doors open to vendors at 7 AM, and open to the public at 9 AM. Admission is $2, and your non-ham spouse and children under 12 are free. Talk-in on 146.94 and 223.82 repeaters, 146.52 simplex. Walk-in Amateur exams for all classes at 10 AM. Applicants must bring check for $4.35 payable to ARRL/VEC, positive ID, original and photocopy of Amateur License and any interim certificates. For reservations write: *Marvin Yale N1CDR, 6 Laurel Terrace, Westfield MA 01085; 413-562-1027 eves, or days 413-532-6411 or 413-532-4891*.

CONNEAUT OH
MAR 6

The Conneaut Amateur Radio Club would like to announce their upcoming Hamfest. It will be held at the Conneaut Human Resource Center, on March 6. There will be exams, food, and prizes. Wheelchair acc. Check in on 7.39/99. Doors open for vendors at 7 AM and for the public at 9 AM to 3 PM. Admission is $3. Eight foot tables are available for $5. For more information contact: *Jack Marttila KA8TUU, 697 Broad St., Conneaut OH 44030*.

YORK PA
MAR 6

The First Annual York Winterfest (Ham and Computer) will be held Sunday, March 6 at the Dover Firehall. Two floors indoor tables and free tailgating. Food, refreshments and prizes. Inside tables $10. Registration is $4. XYL free. Blacktop parking. General admission is at 8 AM. Talk-in on 146.37/97 and 147.93/33. Advanced info and registration: *York Winterfest, 2449 Heidlersburg Road, Gettysburg PA 17325*.

ST. LOUIS MO
MAR 11

On Friday night March 11, the Jefferson Barracks Amateur Radio Club will be holding our 28th annual ham radio auction. The location again this year will be the Concordia Turners Hall. The auction has always been the kick-off of the hamfest season and over 800 people attend. For more information write to: *Jefferson Barracks Amateur Radio Club, c/o Carl H. Hohenberger WB0BZP, 5266 Parker Ave., St. Louis MO 63139*.

AUGUSTA ME
MAR 12–18

The Augusta Emergency Amateur Radio Unit will operate from the state capital using the special Bicentennial call sign, W200TLC, From 0001Z March 12 until 2359Z March 18. Operating will be on all bands and modes 160 meters through 70 cm. For special QSL card, send QSL and SASE to: *W1TLC, Augusta Emergency Amateur Radio Unit, c/o K1NIT, William Crowley, Box 1589, Hallowell ME 04347*.

APPLETON WI
MAR 12

The Fox Cities Amateur Radio Club will sponsor "Swapfest 88" at Appleton East High School, on March 12. Tables $5 (by reservation only). Doors open for sellers at 6 AM, for others at 8 AM. For table reservations or other information contact: *Don Baker NB9J, 621 West 7th St., Kaukauna WI 54130; 414-766-3886*.

CAVE CITY KY
MAR 12

The annual Glasgow Swapfest will be held at the Cave City Convention Center, on March 12. The Swapfest will start at 8 AM Central time and continue until everyone goes home. Admission is $3 per person, tables available at $3 each. Misc. forums will be held along with an excellent flea market. Talk-in on 146.34/94 and 147.63/.03. Additional information from: *N4HCO, 1379 White Chapel Road, Glasgow KY 42141*.

EGG HARBOR CITY NJ
MAR 12

The Shore Points Amateur Radio Club invites everyone to its "Springfest '88" hamfest, to be held on Saturday March 12, starting at 9 AM (sellers may arrive at 7 AM to set up) at the Atlantic County 4-H Center. 8000 square feet of heated indoor selling space is available, with additional space for outdoor tailgating, weather permitting. Limited AC available in indoor space. Sellers: $5 per space (supply of tables limited, request if needed); buyers: $3. Talk-in on 146.385/.985 and 146.52 simplex. For more information write to: *SPARC, P.O. Box 142, Absecon NJ 08201*.

INDIANAPOLIS IN
MAR 13

The Indiana Hamfest will be held on March 13. Open to the public at 8 AM. Sponsored by the Morgan County Repeater Association. Held indoors with 60,000 square feet of space at the Indiana State Fairgrounds Pavilion Building. VEC Exams and Ladies Programs. Admission: $5 at the door. Eight foot flea market table (including space) $8 each. No Space without table will be sold. Advanced reservations requested–Tables sold out in 1987. Setup: Saturday, March 12, 3-9 PM. Sunday, March 13, 6-8 AM. Free paved parking. Talk-In on 145.25. For table reservations or information send SASE to: *Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47401; 812-339-4446*.

VALHALLA NY
MAR 13

The 1988 ARRL Hudson Division Convention will be held in conjuction with the WECAFEST '88 hamfest on Sunday, March 13, at the Westchester Community College. The convention is jointly sponsored by the Hudson Amateur Radio Council (HARC), the Westchester Emergency Communications Association (WECA) and WARY-FM, the college's radio station. The one-day event will be packed with activities, including new ham forums, ARRL workshops, a gaint flea market, FCC Exams and more! Admission is $4 at the door. Talk-in on 147.06, 146.91, 224.40 MHz repeaters. For exhibitor/vendor information, please contact: *Bob or Sarah Wilson by phone at 914-997-8491, or by mail at 2 Soundview Ave., White Plains NY 10606*. For general information, contact: *Program Chairman Rich Moseson NW2L, at 201-680-1585, or write "The Great '88," c/o NW2L, 19 Linden Ave., Bloomfield NJ* 07003.

DUBLIN IRELAND
MAR 17

On St. Patrick's Day, March 17, there will be a most ambitious undertaking, from an amateur radio viewpoint, an attempt to be made to contact the many other towns or cities named Dublin around the globe. (It is estimated that there are over 20) using not only SSB but also with the help of Pre- arranged skeds to attempt to make visual contact in a world-wide amateur slow-scan TV link-up. The Lord Mayor of Dublin, The Right Honourable Carmencita Hederman has agreed if at all possible to partake in the exchanging of St. Patrick's Day greetings with these other Dublins. This station again with the special call sign will be located in Dublin Ireland's main thoroughfare of O'Connell St. It is hoped to relay live SSTV pictures from the front window of a prestigious department store to the public outside. The station will be active on HF for the day. For more information contact: *Shane Halpin, D.M.A.R.C., 25 Knocknashee, Goatstown, Dublin 14*.

CHARLOTTE NC
MAR 19–20

The Mecklenburg Amateur Radio Society is pleased to sponsor the Charlotte Hamfest and Computerfair, an ARRL Sanctioned Hamfest, to be held on March 19 and 20. It will be held at the Charlotte Convention Center. Open Satuday 9 AM to 5 PM, Sunday 9 Am to 3 PM. There will be 150 commercial exhibit booths and over 500 flea market tables. All of the major manufacturers and dealers will be there. All indoors, 87,00 square feet. There will also be plenty of programs and forums, and license exams by the Charlotte VEC on March 20. In addition to hourly gifts. Talk-in on W4BFB/r on 145.29

(-600). The tickets are $5 in advance, $6 at the door, tables are $10 in advance, $12 at the door. Children under 12 free. Tickets and tables are good for both days. Reservations and inquiries may be made by writing: *Charlotte Hamfest, P.O. Box 221136, Charlotte NC 28222-1136*.

FORT WALTON BEACH FL
MAR 19-20

Playground Amateur Radio Club (PARC) will be holding it's 18th annual Ham/Swapfest on Saturday, March 19 from 8 AM to 4 PM and Sunday, March 20 from 8 AM to 3 PM. For more information write to: *PARC Ham/Swapfest, P.O. Box 873, Fort Walton Beach FL 32549*.

MIDLAND TX
MAR 19-20

The Midland Amateur Radio Club will hold its annual St. Patrick's Day Swapfest on Saturday, March 19, at 10 AM to 5 PM and Sunday, March 20, at 8 AM to 2:30 PM at the Midland County Exhibit Building. Preregistration is $5, $6 at the door. Tables are $6 each. Refreshments and food available Volunteer Examiner tests for all categories given. For futher information and reservations, please contact: *Midland Amateur Radio Club, P.O. Box 4401, Midland TX 79704*.

PISCATAWAY NJ
MAR 19-20

The Piscataway ARC will operate a special event station on March 19 and 20 from 0000Z to 2400Z each day, to commemorate the WWII operations of the Voice of America Relay station, WRCA. Members will operate under their own callsign, and sign /VOA. Suggested frequencies are: CW, Novice portions of the bands. Phone, the lower third of the general portion of the bands on 75, 40, 20 and 15 meters and the Novice program on the 10 Meter band. For certificate send #10 or for unfolded a 9"x 12" SASE, with your QSL to the *KO2K* callbook address.

HUDSON NH
MAR 19

The Interstate Repeater Society of The Derry Repeaters, will hold its annual flea market on Saturday March 19th, at the Hudson, NH Lion's Club Hall. Doors open at 8 AM and close at 4 PM admission is $2. Talk-in on the Derry 146.85 and 224.46 MHz Repeaters. Tables are $10 which includes two admissions. Some tables have 110 volt power available. Featured will be Ham equipment and parts as well as computers and components. For table reservations write to: *IRS, P.O. Box 693, Derry NH 03038; 603-434-4435*.

MARSHALL MI
MAR 19

The 27th Annual Michigan Crossroads Hamfest will be held on March 19 at the Marshall High School. This event is sponsored by the Southern Michigan Amateur Radio Society and the Marshall High Photo Electronics Club. Advanced tickets are $2 (SASE) and $3 at the door. Table reservations are .50cents per foot (min. 4 ft). Reserved until 8 AM. Talk-in on 146.66 or 146.52 or 223.94. Send SASE to: *SMARS, P.O. Box 934, Battle Creek MI 49016; or call Wes Chaney N8BDM at 616-979-3433*.

STERLING IL
MAR 20

The Sterling-Rock Falls ARS 28th Annual Hamfest will be held at the Sterling High School. There will be commercial distributor, dealers, a large flea market and camping space. ARRL VE testing. Tickets are $3 advance, $4 at the door. Tables are $5 including electricity. Talk-in on 146.25/85. Testing information write to: *Jim Buikema NR9G, 512 North Genesee St., Mossison IL 61270. Or call 815-772-7874.* For more information about tables or tickets, contact: *Sue Peters, P.O. Box 521, Sterling IL 61081; 815-625-9262*.

WEST HARTFORD CT
MAR 20

The Insurance City Repeater Club annual Amateur Radio and Computer Flea Market will be on March 20. It will be at The American School for the Deaf at 9 AM to 2 PM. Talk-in on 146.28/88. Tables are $10 and admission is $2. For more information contact: *Chuck Motes K1DFS, 22 Woodside Lane, Plainville CT 06062; 203-747-6377 evenings*.

TIMONIUM MD
MAR 26-27

The 1988 greater Baltimore Hamboree and Computerfest will be held on march 26th and 27th at the Maryland State Fairgrounds Exhibition Complex. It is opening at 8 AM to 5 PM on Saturday and 8 AM to 4 PM on Sunday. Admission is $4 or $6 for both days, 12 and under free. For more information and reservations, contact: *GBH&C, P.O. Box 95, Timonium MD 21093-0095; or call 301-HAM-FEST*.

ELIZABETHTOWN KY
MAR 26

The Lincoln Trail Amateur Radio Club's Hamfest Committee would like to announce that the Kentucky ARRL State Convention will be held at Pritchard Community Center, on Saturday March 26. Talk-in on 146.52 and 146.38/98. ARRL VE walk-in testing and numerous forums. Admission $4 advanced, $5 at the door. Vendor spaces $5 each plus ticket. For advanced tickets and set-up reservations and information on exams contact: *Chuck Strain AA4ZD, P.O. Box 342, Vine Grove KY 40175*.

MOORHEAD MN
MAR 26

The Red River Amateurs are once again pleased to sponsor the HOBBIE HI-TECH 1988. It will take place at the Ramada Inn, on March 26. There will be a large indoor flea market and several commercial exhibits. Also seminars and a special recognition lunch for those involved with the Barnsville Digipeator/Repeator. There will be a regular VE Test held in the morning. Talk-in is on 146.76. For more information please call or write: *Tim Gooding ND0YX, 1006 Sheyenne St., West Fargo ND 58078; 701-282-6630*.

UNCASVILLE CT
MAR 26

The Second Annual Radio Amateur Society of Norwich (RASON) Auction will be held on March 26 at the VFW Hall, at 9 AM; Auction from 10 AM until sold out. Admission is free and there will be food available. Bring your equipment to be auctioned. Talk-in on 146.13/73. Call *KY1F* at 203-536-0187 for further information.

GRAYSLAKE IL
MAR 27

The Libertyville and Mundelein Amateur Radio Society is pleased to announce the Lamarsfest 1988. It will be held on Sunday, March 27 at the Lake County Fairgrounds. Doors open at 8 AM and close at 2 PM, setup is at 6 AM. Admission is $2 advance (by 3/18), or $3 at the door. There will be a large indoor electronic and radio swapfest, commercial exhibitors, code speed testing, and prizes. Talk-in is on 147.63/.03, Waukegan repeater 146.52 simplex. For more information please contact: *Lamars, c/o Marc Abramson, P.O. Box 751, Libertyville IL 60048*.

JEFFERSON WI
MAR 27

The Tri-County Amateur Radio Club W9MQB, will hold its Annual Hamfest on Sunday, March 27, from 8 AM to 3 PM, at the Jefferson County Fairgrounds. Tickets are $2.50 in advance, $3 at the door. Tables are $3 in advance, $4 at the door. Reserve early, we sell out early. Amateur exams will be provided from 10:30 AM to 1:30 PM. Doors open at 7 AM for sellers only. Talk-in on 144.89/145.49 or 146.52. For more information, tickets or tables, send SASE to: *TCARC, P.O. Box 321, Milton WI 53563*.

MADISON OH
MAR 27

Never Say Die

Continued from page 6

Then there's the long overdue need to stop funding three branches of the military and meld it all into one single service. With modern transportation and communications, the differences between land, sea and air are narrowing. With one service we might be able to save hundreds of billions of dollars by eliminating the vested interests in obsolete weapons. And isn't it time we changed the name of the Department of Defense to the Peace Department? Heck, it used to be the War Department.

I don't want this to expand to a book—and that's what it would take to go into the many changes we need to get America back to #1 in the world. Making sure that every youngster in America understands electronics and developing a million young hams in the process won't hurt. Perhaps we'll be able then to do more with digital voice and TV communications via amateur radio. We're so far behind the times right now it's pathetic. I don't think we're going to be able to catch up unless we get kids coming back into our hobby.

So, if it makes you feel superior, be my guest and call me crazy. But remember, I've been doing my homework, so I'm ready to explain any of my proposals you think won't work. I'm also wide open for any ideas you may have on ways to get America back to #1. Also, isn't it about time we elected an actual working vice president? Perhaps if we cut a couple cabinet positions and put the vice president in charge of making America #1....?

I don't know if my ideas make sense to you, but the groups I've addressed all seem convinced they would work—and we critically need someone to get our country going again. I've talked with several of the presidential candidates—and listened to the others. Sigh. I sure wish one of them would steal my platform. I'm a businessman, not a politician, so I'd like to see our country run more like a business.

QRP

Number 26 on your Feedback card

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

ON TOROIDS

No doubt you check for the next QRP project to build when the mailman brings the latest ham magazine to your door. Every now and then there's a real dandy. Looking it over, you find it covers five bands, has LCD frequency display, and uses nothing but 555 timer chips and 2N2222 transistors. Looking deeper into the circuit, you find that the designer used toroids. *Oh, no!* Look at T3—24 turns of trifilar wire wound at 8 turns per inch over a T-60 core. Watch polarity. Well forget this mess, I don't know how to wind a simple single layer toroid, let alone a beast like that.

Fear not—this month we look at toroids, and how to wind them, including those nasty trifilar jobs.

The Why of Toroids

Toroids give an exceptionally large amount of Q in a very small mass. This makes the toroid ideal for miniaturization. A toroid inductor is self-shielding. Its core contains nearly all the magnetic flux. There's minimum interaction between tuned stages by using inductors wound on a toroid, which allows toroid placement physically close to other components.

This includes the chassis and other metal parts. Because the toroid core contains within it the magnetic flux, there is tighter coupling between windings, as the case of a secondary winding over a primary winding.

Most cores are highly permeable because they contain ferrite material. This lets the designer use fewer turns in the tuned circuit toroid. Fewer turns mean the designer can use larger gauge wire. This reduces I^2R losses. This is very helpful where transistor collector currents are very high.

Toroids are doughnut-shaped coils. Toroids, like doughnuts, come in different flavors and sizes. They contain either powdered iron or ferrite. Toroids are made with a special type of ceramic.

There are no simple rules in core material selection in circuit design. Many factors are considered, such as operation frequency, and the core's physical size and permeability. The higher the permeability, the fewer turns required for a given circuit Q.

An RF choke in the transistor PA collector requires a low I2R loss, which means fewer turns of the core. This translates to a high-permeability core. Most designers need not worry about what core to use in a given circuit. Most of the letters I receive ask not what core to use, but how to wind those blasted things. If a designer needs to know what core to use for what frequency, Amidon Associates will send him all the needed data. It's free. Write for it.

Collect the required cores before soldering anything together. Sometimes it requires sending off an order via the mail for the required cores. It's awfully frustrating to wait for the proper cores to arrive to finish a project. When you send in your order, be sure to order more than needed. Add them to the parts bin for future needs. Go together with a buddy or club and get the bulk discount.

A Practical Example

Examples of these cores are in the Two-Fer filter. The filter requires one T-50-2 core. We want to build the 40-meter filter. There are, of course, several different winding methods. I find the following method best.

The toroid needs 14 turns of #24 wire on the core. Since the T-50-2 is a rather large core, I hold it in my left hand and wind with the right. Leave a good amount of wire for the lead—about three inches—and trim later. How much wire to start with? Well, that's a tricky one. Fourteen turns translate to about a foot of wire (with margin). Always use a lot of wire when winding unknown coils. Nothing is worse than running out of wire before the coil is done. There are tables to determine how much wire is needed for how many turns.

Stick the wire through the core and, with one finger of your left hand holding it, take your right hand, and feed the wire back through the core. That makes turn number one. Continue winding the core in this manner until you hit 14 turns. Again, leave a good long lead to work with. The ends of the windings should be somewhere in the neighborhood of 20–30° apart from each other. This reduces and distributes the capacitance of the windings.

Now spread out the core windings as evenly as possible. The windings may be wound all together, but they must have an even distribution around the coil when finished.

Removing Wire Enamel

When the windings are in place, scrape the enamel off the wire in order to solder the toroid coil to the PC board. Here are several methods that have worked for me:

•Hold the core in one hand and pull the wire between a piece of sandpaper or emery to remove the enamel. Don't pull too hard, or the wire will stretch and possibly break.

•Let the toroid core hang over a table top and, with one lead held between a piece of sandpaper and the table top, roll the coil back and forth, removing the enamel. Again, be careful, or the wire lead will twist off.

•Scrape the enamel off with an X-acto knife. This is the fastest and most dangerous method. Those knifes are verysharp. Too much pressure will nick or cut through the wire. A nicked wire will break later.

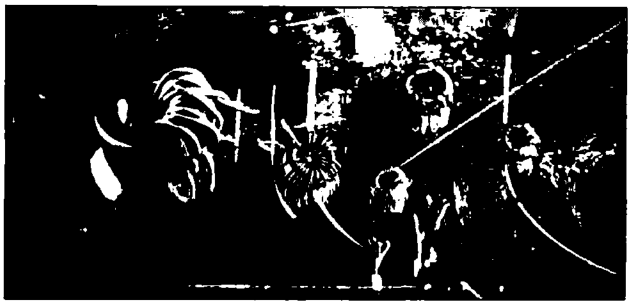
•This last method works only on wire with certain types of enamel coating. Get a small metal cup (e.g. a spray can lid) and pour in semi-gell paint remover. Mount the toroid coil on a small square of perf-board and let the wire leads sit in the paint remover.

Next mount the toroid coil to the PC board. I stand the coils upright on the PC board. Sometimes I use a drop or two of super glue to hold the core in place. This keeps the coil from flopping around and prevents lead break-off. If the coils are intended for, say, a VFO, use silicone sealer to hold and cover the coils. This keeps the coils from moving and changing the VFO frequency. A good source of silicone sealer is bathtub caulk. A $3 tube lasts for years of building.

Trifilar Coils

There is nothing magical about winding these coils. Use the same procedure as for the single wire coils. The tricky part is getting the three wires wound together. This requires several things before starting: the wire, a file cabinet, a hand drill or hand egg beater, and a couple of minutes of time.

I like to twist about three to five



Save time and money by winding your own coils.

This receiver was a snap with home wound toroids.

"There is nothing magical about winding (trifilar) coils."

feet of wire at a time. I use what I need, mark the rest and return them to the junkbox. Start by wrapping one end of the wire to the file cabinet handle. Almost anything can anchor the the wire, but file cabinet handles work best.

With an eye screw in the bit of the hand drill, pass the wire through the eye and back to the file handle. One more time loop the wire through to the eye hook in the drill bit. This gives three runs of wire between the drill and the file cabinet. Now start twisting the wire together. Use the hand drill and turn the handle to twist the wires. Keep turning the handle for a nice even twist. Don't worry about that "eight turns per inch" stuff for what we are doing. Don't twist the wire so tightly as to cause the wire to knot up. Cut the wire from both the file cabinet handle and the drill bit. The result is a length of tri-wound wire.

In the absence of a hand drill, use a hand-powered egg beater. Use a variable speed electric only with great care. A bent six-penny nail can be used for the eye screw.

One, Two, Three

To finish winding the coil, start by placing six inches of wire through the core. Wind the proper amount of wire on the core and leave another six inches of wire on the other end.

Separate the three wires from each end of the coil. Remove the enamel from all six leads. Now, with the help of a trusty VOM, attach one test lead to one wire. Find the other end of this wire. (VOM set for ohms, R x 1) Cut both ends down to four inches. Go to the next lead and find its mate. Cut both these leads to three inches. Of course, the last wire pair will be the third coil. Cut both these leads down to two inches long. Now all three wires have been identified and marked. The longer wire is number one. Next longer wire is number two, and the last wire is number three. Still with me?

Now to take care of those phasing dots. With the leads identified, the coils can easily be phased together. Mark on the schematic phasing dots 1, 2, and 3. Their order isn't critical, but I usually mark the top dot 1, next one down as 2 and so on. Since the longest wire is dot number 1, I can play connect the dot!

Dot 1 goes to Q3 base, Dot 2 connects to the other end of Wire one. End of wire 2 goes to Q4 base. Simple. Using this method will really take the scare out of those trifilar coils.

That takes care of toroid winding. Practice winding coils on different cores. I have a good stock of pre-wound coils in the part bins. I wind more turns that I will need, and later on when I do need a coil, I just remove the unneeded turns. This really saves time when experimenting on different circuits.

That's all this month. Again, I ask for photographs of your stations, projects, or anything QRP-related that you want to send along. Stock up the junk box—we will be doing some receiver building this year.

QRP CONTEST RECORD SET

Danny Eskenazi K7SS shattered without question the world record score for single operator, QRP class in CQ magazine's SSB contest last October. While operating an ICOM IC-735, Danny's 3200 contacts gave him an initial score of over 3,000,000. TG9GI held the previous QRP record score of 1,035,683 since 1982.

Danny operated from friends' home in Curacao (PJ). Citing the IC-735's compact size, he said, "I had a complete QRP DXpedition station in a box! I took extra microphones, clocks, coaxial cable, a backup power supply, wire pencils, coffee, and vitamin C, but only one radio. . . I knew that's all I would need." He also used a digital voice keyer, boom headset, and a Cushcraft TH-6 antenna at 70 feet. He considers his best contact KH6CC in Hawaii on 160 meters!

Although big gun multi-multi stations PJ1B and P40V combined to work more than 30,000 contacts, Danny proved that five watts from a great radio and a determined operator can work wonders. He plans to return to Curacao next year.

Thanks ICOM America.

INDEX: March 1988

Number 40 on your Feedback card

Number 28 on your Feedback card

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B3353
Fieldstone Dr.
Doylestown PA 18901

To Mast-Mount or Not to Mast-Mount

Thinking of spending a few hundred dollars and installing a mast-mounted preamplifier for one or more VHF/UHF bands? Read on.

What Transmission Line?

The contemporary VHF operator can choose from a wealth of transmission lines. He can equip a station with everything from inexpensive RG-58/U-size cable all the way up to ½", ⅞" and 1 ⅝" hardline—even flexible waveguide, if he can afford it! However, much of hamdom must compromise between cost and performance. . . and cost usually wins.

Belden 9913 is a relatively inexpensive cable that has made it much easier for new hams to be active on the higher frequency bands with modest power. Belden 9913 has its limitations, such as its remarkable ability to absorb water if not properly waterproofed, but there's no debating its excellent low-loss characteristics, especially at 432–1296 MHz. Half-inch hardline retails at over $1 per foot, and ⅞" line at over $3. Belden 9913 looks very attractive at under .50/foot.

Since my cable runs are fairly short (65 feet or less), I've put 9913 into service on every band except 50 MHz and 2304 MHz. (On 6 meters, 8214 foam is more than adequate at about 1.5-dB loss per 100 feet. On 2304, I've used a 35' piece of Heliax with 9913 pigtails to a loop yagi.)

Based on portable contest observations and tests performed here, it appears that, for most stations:

- running 500 watts or less;
- on 432 MHz and below; and
- with up to 100 foot cable runs

Belden 9913 is the best balance between cost and performance—provided the operator installs the connectors properly and the line is completely waterproofed. At power levels above 500 Watts (depending on frequency) the line may flash over, especially when moisture is present. Feedline losses start to pile up, too, with lengths over 100 feet.

Don't Spend Yet

A mast-mounted preamp probably isn't necessary if a station system fits within the above parameters. Most of today's amateur VHF equipment uses low-noise, high-gain devices in the front-end and mixer stages that easily overcome modest line losses.

Stacking antennas is another easy way to improve the overall gain of a system. Consider that transmission line losses at 432 MHz with 9913 amount to 2.5 dB per 100 foot run. This can be made up just by stacking two matched yagis.

Configuring a Preamp

If the operator must run extremely long feedlines above 144 MHz, a mast-mounted preamp helps. It's best to use two separate lines with a single SPDT relay at the antenna. Low-loss cable such as ½" or ⅞" hardline is used for the transmit leg, while a length of 9913 or even 8124 can be used on the receive leg, with the preamp situated just after the relay. This scheme offers a great degree of protection, since the relay is usually wired "hot" during receive. When power is switched off, the preamp is out of the line.

Using two feedlines as above allows best use of the typical "hot" GaAsFET preamplifier, which usually has too much gain to be put just ahead of the receive converter or multimode down in the shack. For example, suppose a ham uses an ICOM IC-475A, which has about .15µV sensitivity for 10 dB S/N ratio and a 1-dB compression point of +4 dBm. Putting an 18 to 20 dB gain preamp without a 50Ω pad just ahead of the radio will likely degrade overall receiver performance.

Installing the same preamp at the head end of a 100 foot run of 8214 cable makes more sense. If the preamp has 20 dB of gain and the feedline has 4 dB of loss, there is 16 dB net gain at the shack. This brings the .15 µV signal up almost 3 S-units. The preamp will also appreciate operating into something that looks like a smooth 50Ω load, and the chances of oscillation are reduced if not eliminated.

One particular operator used ⅞" hardline with mast-mounted preamplifiers and eventually brought all of them back into the shack. In this instance, the feedline lengths were all under 125 feet, and the added gain wasn't worth the additional trouble of a sequencer, extra DC control lines and repeated failures at critical times. The operator found that most of the signals he heard were at least 10 dB out of the quiescent band noise, and installing the preamplifiers in the station with an appropriate 50Ω pad worked almost as well.

Additional improvements were made with the installation of stacked 4-bay arrays where one yagi was used previously. At 432 MHz, this more than made up the losses incurred in the feedline by a factor of 3. This was a very practical solution. ⅞" hardline typically exhibits losses of 1 to 1.25 dB per 100 foot run. Stacking another yagi would in effect cancel out the losses in a 200 to 250 foot run of

CONFIGURATION #1

Element	Type	Gain
Antenna	23 element yagi	1[illegible] dB
Feedline	RG8/U poly coax, 100 ft.	-10 dB

With a signal of 10 dB S/N at the antenna feedpoint, it will be 0 dB S/N at the 1296 Mhz receiver (at threshold noise level).

CONFIGURATION #2

Element	Type	Gain
Antenna	23 element yagi	16 dB
Feedline	Belden 9913 coax, 100 ft.	-8 dB

With a signal of 10 dB S/N at the antenna feedpoint, it will be 4 dB S/N at the 1296 Mhz receiver (almost 1 'S' unit).

CONFIGURATION #3

Element	Type	Gain
Antenna	2 X 23 el yagi	21 dB*
Feedline	Belden 9913 coax, 100 ft.	-6 dB

With a signal of 13 dB S/N at the antenna feedpoint, it will be 7 dS S/N at the 1296 Mhx receiver (over 1 'S' unit).

CONFIGURATION #4

Element	Type	Gain
Antenna	2 X 23 element yagi	21 dB*
Feedline	7/8" hardline, 100 ft.	-3 dB

With a signal of 13 dB S/N at the antenna feedpoint, it will be 10 dB S/N at the 1296 Mhx receiver (almost 2 'S' units).

PREAMPLIFIER CONFIOFURATION #1

Element	Type	Gain
Antenna	2 X 23 element yagi	21 dB*
Feedline	7/8" hardline, 100 ft.	-3 dB
Preamplifier	18 dB at station, 2 dB NF	16 dB**

With a signal of 13 dB S/N at the antenna feedpoint, it will be 20 dB S/N at the 1296 Mhz receiver (about 3 1/2 'S' units).

PREAMPLIFIER CONFIGURATION #2

Element	Type	Gain
Antenna	2 X 23 element yagi	21 dB
Feedline	7/8" hardline, 100 ft.	-3 dB
Preamplifier	18 dB at antenna, 2 dB NF	18 dB**

With a signal of 13 dB S/N at the antenna feedpoint, it will be 23 dB S/N at the 1296 Mhx receiver (about 4 'S' units).

* - Note: This figure assumes nominal 3 dB gain for stacking 2 identical yagis with conventional spacing.

** - Adjusted for noise figure degradation (2 dB noise figure)

Table 1. Tabular form of the six antenna system configurations discussed.

⅞" line. Hardly cause for a mast-mounted preamplifier!

Some Microwave Non-Preamp Configurations

At 903 and 1296 MHz, there are many options to juggle. Antennas are physically smaller and stack easier to achieve additional gain. On the other hand, feedlines are lossier and noise figure becomes more critical. Let's look at some configurations.

The first configuration is a 1296 MHz station constructed around the SSB Electronics LT-23S transverter, which has a GaAs-FET front end with low-noise figure (under 2 dB). A small 23-element yagi with 18 dBi gain is selected. If conventional RG-8/U is selected for a 100-foot run, feedline losses approach 10 dB—substantial! System gain is thus 8 dB.

In the second configuration, 9913 cable replaces RG-8/U. The losses in that 100-foot run now are reduced to about 6 dB bringing the system gain up to 12 dB.

Let's replace the 23-element antenna with two stacked models in a third configuration. The system net gain is closer to 15 dB, and the previous losses are reduced in effect from 6 to almost 3 dB.

Using ⅞" hardline further reduces losses by 2.5 dB. This fourth system now approaches 17.5 dB—only .5 dB worse than the preamp configuration. There is an improvement of almost two S-units in the fourth configuration over the first—and no preamp is used. (At this point, an outboard preamplifier enhances signals at or below the threshold noise level. With an 18 dB preamp and 100 feet of 9913 on the receiver line, those signals improve as much as 2 S-units above the noise.)

"Who wants to climb up a tower during a nice tropo session to make preamp repairs?"

I'm FB, You're FB

In my system, a Tonna 55-element yagi feeds about 65 feet of 9913. Let's calculate the overall gain.

This antenna indicated 21 dB of gain on the test range. The feedline incurs 3.9 dB of loss, leaving a net gain of 17.1 dB. The S/N degrades by about 4 dB (1 S-unit) at the LT-23S. With 60 to 70 watts output, system performance offers something close to reciprocity—the station I can hear can also hear me.

Running a simple GaAsFET preamp at the shack of about 10 to 12 dB with a 1 dB noise figure makes it somewhat easier to hear those stations just above the noise level without much additional noise. On the other hand, installing a mast-mounted preamp probably requires a boost in output power levels to almost 200 watts (about a 4.5 dB increase) to realize any benefits. Otherwise, I'd be hearing and calling stations that might not respond. A more worthwhile improvement is to stack a pair of these yagis to pick up another 2.5–3 dB.

Final Words on Preamps

Use the best affordable receiver, erect the highest gain antenna that space and budget will allow, and select the lowest-loss affordable feedline. Only after these three parameters have been considered should one mast-mount preamplifiers for additional gain. Properly installed, antennas and feedline yield years of trouble-free service. No matter how careful a ham is with a mast-mounted preamp, it can still blow out from lightning and power line transients. Who wants to climb up a tower during a nice tropo session to make preamp repairs?

Curl up with a Good Book

The VHF/UHF Manual, edited by G.R. Jessop G6JP, is an excellent source of reference material for today's VHF/UHF operators. It's published by the RSGB (Radio Society of Great Britain) and available in the US through the ARRL and other book-by-mail services. The book is written in an easy-to-read style that contains a wealth of technical information, including an excellent section on wave propagation. A thorough discussion of tropospheric enhancement is presented. It also touches on weather terminology such as dew point, refractive index, and adiabatic processes.

There is a wealth of circuits. Although most of the components specified are of European nomenclature (such as RF transistors), tinkerers should be able to transpose to the more common numbers found in North America. Among the circuits are low-noise preamplifiers, converters, and a complete 144 MHz multimode receiver. There are also transverter, transmitter, and power amplifier circuits. There's also a large section on VHF and UHF antenna arrays.

Sections on microwaves, space communications and test equipment round out this book, which gives new meaning to "10 gallons in a five-gallon hat." The price is very reasonable, and it's an invaluable reference. Do yourself a favor and pick up a copy.

Coming Attractions

In the next two months, I will go into detail about my experiences with the LMW 2304 MHz transverter kit, which has just been completed. This unit consists of 6 separate boards—Universal Local Oscillator, Receive converter, Transmit converter, 144 MHz IF amplifier, Low Noise 2304 MHz preamplifier, and 2304 MHz Power Amplifier. Rather than do a typical product review, I will go through the assembly of each board so readers can benefit from the trial and tribulations encountered along the way.

The LMW kits are an inexpensive way to get active on 903, 1296 and 2304. The circuits are fairly simple and in most cases, easy to align and put on the air. There are little tricks, however, that a builder needs to be aware of in order to complete the project successfully. I hope that these columns will do just that. Perhaps readers may want to try their hand at assembling one of these kits in time for the summer... Until next month, see you Above and Beyond! ■

PACKET TALK

Latest in Digital Hamming

Brian Lloyd WB6RQN
19200 Tilford Way
Germantown MD 20874

Letters, Equalization, and Modems

WA6IGY Letter

Thomas Allen WA6IGY sent me an interesting letter. Tom worried that a properly equalized radio may be incompatible with a radio where the TNC is attached to the mike and speaker jacks. Tom also worried that removing the MF-10 and its bandpass characteristic would also degrade packet radio system performance.

Tom is right to be concerned. About equalization, it's very important that the demodulator duplicate as closely as possible the modulator output. This occurs only if the radios use the same equalization, and that is very unlikely (see last month's radio evaluation). By bypassing the trouble-causing stages in the radio, i.e. the clipper/limiter/lowpass filter in the transmitter, and the receiver audio stages, you know your starting point.

Modems clearly work, albeit poorly, with improperly equalized radios. If they didn't, most packet radio enthusiasts wouldn't be on the air at all. It would be nice if everybody took the time to ensure that their radios are properly equalized. It would be even nicer if the radio manufacturers considered packet to be a legitimate mode of operation, and design their radios accordingly.

MF-10 Filter

A bandpass filter ahead of the XR-2211 is desirable but that's not ail that the MF-10 does. Designed also into the MF-10 is an EQ curve meant to boost the high tone by approximately 6 dB relative to the low tone. Since the XR-2211 is very sensitive to level differences in the tones, this high boost probably does more damage than out-of-band noise resulting from no bandpass filter. If you have the design capability to correct the EQ curve of the MF-10 filter, send your results to me so I can publish them here.

The simplest approach—the fewest components between the modulator and the demodulator—is the best. What you really want is your radio link to appear to be a piece of wire between modulator and demodulator with nothing added or removed from the signal. Every amplification or equalization stage reduces signal quality to some degree. A non-linear amplification stage or an improper EQ stage is a serious problem.

Modem Alternatives

Let's face it, using a Bell 202 modem with an NBFM radio is not very efficient. The 202's signal spectrum taxes the capacity of the radio's audio channel. We then use 12–15 kHz of RF bandwidth to transmit the signal—and all for a measly 1200 bits/second. There has to be a better way.

The first thing we can do is stop using NBFM radios and begin using linear (SSB) radios. Hams have been doing this for a long time in HF packet and RTTY. There's no reason why we can't do it on VHF and UHF as well. There are manifold advantages to transmitting the modulating signal directly (baseband) over sending it as an audio subcarrier over FM.

First, you save many kilohertz of bandwidth. Second, linear receivers produce a better S/N ratio under weak signal conditions than do FM receivers because of the FM threshold effect. This means that SSB allows us to fit more stations into a given amount of spectrum and we will not need as much power than with FM. It's not unreasonable to replace a 10 watt NBFM link with a 100 mW SSB link.

We could continue to use 1000 Hz shift FSK (Bell 202), but that poses problems with most of the available SSB transceivers. Most SSB transceivers have a 2.4 kHz wide filter designed to pass a communications-quality voice signal. While this may appear to fit perfectly (2,400 Hz wide signal in a 2,400 Hz wide filter) the fly in the ointment here is nonlinear group delay. This means that signals near the edge of the filter's bandpass propagate more slowly. This can distort the signal. Most modems can tolerate a small amount of this distortion but probably won't work with the amount that would occur in this situation. To make it work, we need to do one of the following: reduce the baud rate and the shift, widen the filter's passband, or come up with a more efficient modulation scheme. I've seen the cost of filters, especially those designed to minimize group delay and I'm not willing to double the cost of the radio. I also want to continue to send data at 1200 bauds or faster. This leaves me with one option: a different modulation scheme.

There are alternatives to FSK. Minimum Shift Keying (MSK) is a special case of FSK. MSK is characterized by a shift exactly half the baud rate (600 Hz for 1200 bauds). The biggest advantage of MSK is its greatly reduced bandwidth requirement. (The reason for this has to do with the phase relationship between the modulating signal and the carrier.) Where FSK has an efficiency of about 0.5 bps/Hz (it takes 2400 Hz of bandwidth to get 1200 bps), MSK has an efficiency that approaches 1 bps/Hz. Because of this, you need only slightly more than 1200 Hz of bandwidth to send 1200 bps. The reduced bandwidth requirements make the signal fit very nicely into a 2.4 kHz or even a 1.8 kHz wide filter. This is even an advantage when used with an NBFM transceiver. The narrow bandwidth of the modulating signal tends to minimize the equalization problem. This is a monumental improvement over the Bell 202 type modems.

There are MSK modems available for amateur packet radio. The 56 Kbps modem designed by Dale Hetherington WA4DSY generates an MSK signal and requires only 70 kHz to send data at 56 Kbps.

There are switch settings and minor component changes that will allow this modem to operate at speeds as low as 9600 bauds where the spectrum is no wider than a conventional NBFM voice signal. But what do we do on 10 meters and with our existing SSB radios? We use the MX-COM MX-519 modem, of course.

MX-519 Modem

MX-COM, Inc., of Winston-Salem NC, produces the MX-519, a one-chip 1200 baud synchronous MSK modem. This chip offers everything you need for a synchronous packet modem. It provides transmit and receive clocks, eliminating the need for a divider chain and a state machine. It also has a carrier detect circuit that does a first-class job of differentiating between QRN and a valid signal. This is something the 7910 World Chip modem, used in most commercially produced TNCs, doesn't do at all.

1200 Hz and 1800 Hz are the two modulating tones for the MX-519. The total bandpass required extends from about 800 Hz to 2200 Hz. This signal is very compatible with radios designed for voice operation (either FM or SSB). A TNC designed using this modem would be much simpler and probably cheaper than existing TNCs. Kantronics began to offer this modem as an option on their products. If you're interested in this modem I will have a construction article featuring it in a future issue of 73.

The demodulator in the MX-519 chip is a relatively ordinary FSK demodulator. This means you must give up about 3.9 dB in performance (the S/N ration must be 3.9 dB greater than the theoretical minimum for a given bit error rate). This, on the other hand, makes the MX-519 compatible with ordinary FSK modulators if they've been set to a shift of 600 Hz (1200 Hz and 1800 Hz tones).

The MX-519 is a real winner on 10m HF and with NBFM radios. All of the radios I evaluated last month should work well sending MSK data. The narrower bandwidth required by MSK pretty well does away with the EQ problems in the radios.

Icing on the Cake

It's possible to adjust existing TNCs that use the Exar 2206 modulator and 2211 demodulator (TNC-1 and TNC-2 compatible TNCs) to be more or less compatible with the MX-519. It won't be as good as an MX-519 talking to an MX-519, but it will work. (It's a shame that the 7910 World Chip modem isn't compatible with the MX-519). Simply adjust the 2206 modulator to generate a 1,200 Hz low tone and an 1,800 Hz high tone. The 2211 is adjusted to have a center frequency of 1,500 Hz instead of 1,700 Hz normally used for Bell 202 compatibility. That's all there is to it! I will report back next month after we gather some more performance data.

As nice as the MX-519 is, it's not perfect. In many cases it's not possible to give up the extra 3.9 dB of performance. There exists another modem for packet radio that has failed to receive the notoriety it deserves. I speak of the TAPR/AMSAT Binary Phase Shift Keying (BPSK) modem. The BPSK modem was designed to receive data from the satellite FO-12. Satellite communication

enthusiasts face the problem of limited power budgets available on most satellites, which do not permit high transmitter power. The difference must be made up in the receiving system, so every dB counts. The BPSK modem was designed to eke the last ounce of performance from a run-of-the-mill SSB radio. Its performance is within one dB of the theoretical maximum performance.

Anything that works this well in space can be used here on Earth. Several hams were working on the problems of moving packets around the state of Alaska. Parts of Alaska are somewhat inhospitable. Planting a digipeater on a mountain top is a serious exercise. These hams were experimenting with meteor scatter propagation as a possible solution to the problem (there is a continuous rain of small meteors that provide weak but reliable paths for many seconds out of every minute). They found the modems in the TNCs to be totally useless for this and the K9NG 9600 baud modems were not much better.

Tom Clark W3IWI visited Mike Rice KL7YV and just happened to have a pair of the then-experimental BPSK modems. Tom and Mike set up a test on 10m using a Yaesu FT-980 and a Kenwood TS-940. They performed the initial tests at full power over a 20-mile path that was not line-of-sight. As they determined that the channel was a good one, they began to reduce the power output from the transmitters. They found they could maintain reliable communications using only 2 to 3 mW of power. Tests of the lockup time showed that they needed a value of 10 to 20 ms for TXDELAY (the time between activation of PTT and the beginning of data transmission). Contrast that value with the 100 to 200 ms needed by most NBFM radios and Bell 202 modems.

The modem does have one rather clever bit of engineering. The demodulator generates a DC offset voltage when the carrier signal is either high or low. A comparator circuit recognizes this offset, and activates the frequency up/down control lines available at the mike jack of most of the current crop of SSB transceivers. This forms a digital AFC for the radio. This is primarily intended to permit hands-free correction of Doppler shift as a satellite moves across the sky, but works very well when used to provide correction for off-frequency stations while round-table operations are going on.

If you are interested in experimenting with the TAPR/AMSAT BPSK modem it's likely to be within your reach. TAPR sells a complete kit less enclosure for $100.

"The MX-519 is a real winner on 10m HF and with NBFM radios."

This includes everything you need for both terrestrial and satellite experimentation. This modem is designed to plug into TNC-1 or TNC-2 compatible device. Other types of TNCs should work as well if they have some sort of connector that allows external modem attachment.

Software Modem!

Tom Clark W3IWI and Bob McGwier N4HY have been working on a project involving the use of the new digital signal processor (DSP) chips. A DSP is a very fast processor that allows replacement of dedicated analog components with a DSP and some software. The DSP proposes to do for modems what the microprocessor did for dedicated control circuitry. Remember what rigs were like before microprocessors?

Tom and Bob have been working with an experimental board for PCs that permits construction (in software) of many different types of high-speed repetitive processes. So far Bob has constructed a number of interesting modems in software. Bob has implemented FSK, MSK, and PSK modems ranging from 1200 to 9600 bps including most of the commercial modems in the CCITT book. They are working on a newer, faster board to permit construction of 9600 bps and faster modems that can work with our existing crop of radios (they use adaptive equalization to automatically correct for the poor equalization built into our radios on a radio-by-radio basis).

If you think you might be interested in the software modem project, contact Bob McGwier N4HY for more details. His address is 15 Cherry Brook Road, East Windsor NJ 08520

Until next month!

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from page 26

tenna. One may expect the full-size ¼-wave antenna, also tested here, to radiate more efficiently than the extended duckie, but the averaged results didn't show a difference.

On-the-air testing gave similar results, with no discernable differences between the two antennas. There were a few instances when the extended duckie and the ¼-wave antenna outperformed the stock antenna, when keying a repeater in a fringe area. Even in those cases, the longer antennas only made the signal less "scratchy."

½-wave

This beast is 41-¾ inches long when extended. It collapses to 8-⅜". The base section without the rest of the whip gave an SWR of over 3:1. On the air, the ½-wave antenna's performance was often amazing. A signal marginal on the stubby or stock antenna often was full-quieting on the ½-wave antenna. There were similar reports on the transmit side in a number of instances when attempting to use repeaters some distance away.

This antenna can make the difference between working someone and being lost in the noise. A ham won't want to carry this antenna around anywhere while fully extended, for fear of eventually damaging the radio's BNC connector or the antenna itself on some low-hanging object. This is less of a problem than with some of the ⅝-wavelength antennas on the market, but it is still a reasonable concern with an antenna approximately 3-½ feet long.

Summary

The "best" antenna here is defined by the ham's situation. For example, in a moderately large metropolitan area with numerous repeaters nearby, the stubby version will be a good choice—more than adequate performance in a smaller package.

"The 'best' antenna here is defined by the ham's situation."

Now for the helical ¼-wave and the full ¼-wave. These are for the ham who lives in a fringe area of a repeater of interest and just doesn't quite make it with the standard antenna. Both are noticeably larger than the stock antenna, but are not so large to create a hazard.

The more rural ham who doesn't want to be tied down by a fixed outdoor antenna should consider the ½-wave. They're great for operating at rest, but are often too clumsy for ambulatory operation. They are the most expensive of the lot, but they offer a significant improvement in signal strength over a standard rubber duckie.

A parting comment: with any of these antennas, if conditions are marginal, make sure to hold the antenna vertically. Antenna gain can drop up to 20 dB from the vertical to the horizontal position. It isn't uncommon to see a ham tilt his HT a considerable amount away from true vertical when holding the radio to his face. Even a 30-degree angle can make a change in signal strength that is greater than the differences seen when switching between the antennas described here.

	Stout Helical	Standard Rubber Duckie	Helical ¼-wave	Full-size ¼-wave	½-wave
Measured	−9 dB	−6 dB	−3 dB	−3 dB	−0 dB
Expected	−8 dB	−5 dB	−3 dB	−2 dB	−0 dB

Table 1. Measured and expected antenna gain figures for the listed HT antennas, relative to a ½-wavelength HT antenna.

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

XT to the Rescue

Spring is finally on the horizon, and new things are blooming here at WA3AJR. The mail's been hot and heavy on the January Color Computer RTTY program. Many of the readers have been typing in the program from the magazine listing, and others have been downloading it from Delphi or requesting a copy from me. My offer stands—to obtain the program, send two dollars and a self addressed, stamped disk mailer and disk (or tape mailer and tape), and I will dump and mail off a copy.

Also new and exciting at the station is a "PC-XT compatible." I'm impressed with both how powerful the MS-DOS systems are and just how well the CoCo running under OS-9 performs! It often takes running a "big system" (if one can call the XT clone that) to appreciate what a well-designed little sibling can do. This gives me more reason than ever to look for RTTY programs for the PC.

Letters Department

Last month I mentioned that Ralph N. Della Rocca WA2STO, of Oakland, NJ, was looking to make WAS on RTTY. I received a nice note from him saying that, with RTTYers' help, he achieved this goal. Congrats, Ralph! Any more RTTYers out there want to try for this one?

At least a few readers asked where to find the "Galfo" program to run RTTY on an Apple II. This is an integer BASIC Apple program, and, the last I heard, was being offered by AEA in Lynnwood, WA, as their CP-1/Apple-1 disk, for about $30. Call them at (206) 775-7373.

Some readers are looking for specific information on the Teletype™ Model 35. I printed what I could about the Model 28 and Model 33, but I so far haven't found any info on the Model 35. I believe it's a Baudot version of a Model 33 (ASCII), so it should be useful on amateur RTTY.

Amiga users unite! By converting the ASCII to Baudot conversion outside of even a simple program, as in Figure 1, the UTU will run. Thanks, Harry!

I have a letter from Orlo Hudson W5LVA, of New Strawn, Kansas. Orlo's having trouble finding old-fashioned Teletype paper tape. My basement is one source! I have about 100 rolls to send out to anyone wanting them. This is the old yellow paper tape, live-level variety, as opposed to the eight-level tape the Model 33s use. It's the narrow stuff used on Model 19s and Model 14 equipment. For five bucks to cover handling and mailing, I'll send out boxes until they're gone. Those in the area can just stop by and take what they need.

I hope the readership will inform me of other sources of this tape, especially Mylar-based tape.

Guy Woods WA4KCN of Nashville, TN, is looking for a terminal program for the Kaypro computer that works with the AEA PK-232. He says that, while he has a C-64 and PK-64, RFI is a real problem.

I sympathize with Guy. With my CoCo setup, which includes an external bus and all kinds of cable going in and out, RFI is worse than on a stock CoCo. The buzzing is often bad enough to obscure the signal to copy. (Using the PC clone, I'm impressed by the lack of chirping birdies as I tune across the dial.)

Any terminal program currently used to access a modem will work just fine with the PK-232. I'm using a "shareware" program called QMODEM, which supports all kinds of bells and whistles. It is available for MS-DOS machines on many local BBSs. Similar programs, I am sure, are available for the Kaypro. Good luck, and again, let us hear from you.

The next letter comes from Rodolfo Frederico Dibo PY1ACG of Rio De Janeiro, Brazil. He writes that his computer is a Brazilian computer—an XP800 Expert MSX—and he wants to put it on RTTY.

It's likely the MSX is compatible with something here in the States, but what? I look for the readers' input on this one, and will pass along what turns up.

Another success story to report. A while back, I related the tale of Paul Johnston KA5FYI of Austin, TX—the "Texas Turkey" who wanted to get into RTTY. He related going with the C-128, and running a Kantronics KAM with the computer in C-64 mode. Having used all modes except AMTOR, he offers a few comments.

> *"Any terminal program currently used to access a modem . . . will work just fine with the PK-232."*

"Even though there are several programs on the Pacterm disk, only the 'Pacterm' program works with the KAM when hooked up with the five wires on the card connector as explained in the program's instructions.

"Despite the name 'Pacterm,' it works on CW, RTTY, ASCII, AMTOR and packet with the KAM. The other programs on the disk work with Kantronics' other terminals.

"There is no 'type ahead' feature with Pacterm. However, it does have the feature of file transmission. This is handy.
The operator can record various typed responses found in a prerecorded 'first QSO.' Just call the file up and have it transmitted and save yourself some typing. Pacterm also provides for storage of a conversation on disk.

"The instructions to the KAM are poorly organized and written for a beginner to computers and computer communication interfaces. I understand that technical manuals are sometimes poorly written and organized. I'll have to accept that, but don't like it.

"The KAM has two ports, VHF and HF. VHF is bound to packet unless the operator removes the wires going to the HF rig from the HF port and connects them to the VHF rig. Then two-meter CW and ASCII are available. Of course, the wires to the VHF rig from the VHF port are not connected at this time. A switching console would be handy here."

The above is a summary of Paul's letter. It sounds like he worked through all his early problems. No doubt the folks at Kantronics, who read this column, will send me the rest of the story!

Other Digital Communication News

This column is on more than just RTTY. It tries to cover all facets of digital communications and computers.

Here's a challenge from Bud Barber, in Aurora, CO. Bud would like to use his computer to read the digital time information transmitted by WWV and affiliates. I recall an article in QST years ago about how that information was encoded, but can't locate it now. I believe that it was ASCII at some high rate. Of course, it could have changed since then, but anything is workable with enough information.
Anyone know about this one? Drop me a line, and I'll put it through to the masses!

A Decade of RTTY Columns

Still available from the dusty stacks here is a list of past RTTY Loop columns for reprints of the last eleven years or so. I'll send the index along for a self-addressed, stamped business-sized envelope with two ounces of postage on it. Reprints are two dollars and a SASE. All three published CoCo RTTY programs are also available, with the latest and greatest as detailed in January, 1988, and mentioned above. And, of course, I make every effort to respond to all questions. For a mailed response, be sure to include the SASE. Electronic folks reaching me via CompuServe (75036,2501) or Delphi (MARCWA3AJR) get off luckier, but it's hard to send diagrams on E-mail!

Until next month!

SIMPLE AMIGA TERMINAL PROGRAM

```
OPEN "COM1:300,N,8,1" AS 1
WHILE 1
  WHILE LOC(1)>O
  PRINT INPUT$(1,1);
  WIDTH 77

WEND
  I$=INKEY$
  IF I$>"" THEN PRINT #1,I$;

WEND
```

Number 31 on your Feedback card

Hams Around the World

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

Jim O'Connell presents the DX Hog of the Year Award to W9DWQ.

DX Gatherings

What do DXers do when they're neither tuning the bands nor putting up new antennas? They're probably getting together to boast about the rare DX they worked, the pileups they busted and occasionally the ones that got away. They do this on the air, at local club meetings, and at major DX gatherings around the country.

Visalia

The largest of the pure-DX gatherings in the country, and possibly the world, happens every year at the International DX Convention in Visalia, California. The Northern and Southern California DX Clubs originally selected the Visalia site to hold joint meetings there, because the location is about the same distance from Los Angeles and San Francisco.

Visalia convenes in April, usually the weekend before the Dayton Hamvention. The Northern and Southern California DX Clubs sponsor it in alternate years. The 1988 dates are are April 22–24, and the sponsor is the Southern Cal DX Club.

Visalia offers 48 hours of solid DX and DXers beginning Friday afternoon, as hundreds of DXers carpool to remote Visalia from the population centers of the state. Out-of-staters and foreign guests and visitors often hitch rides with the locals. Once a year, the central California 2-meter repeaters bristle with dozens of world famous DX callsigns.

A cocktail party and dinner caravans to downtown Visalia cap Friday evening. By hanging around the pool on Friday, a DXer will spot many of the best known DX callsigns from all corners of the globe: OH2BH, ZL1AMO, SM0AGD, LA1EE, D44BC, W6KG and W6YL, K5VT, W3AZD, and dozens more.

The formal program starts early Saturday morning. Thisincludes contest and DX forums, DXpedition presentations, CW copying contests, antenna seminars, and technical programs. It's capped by a banquet with the guest of honor that night. The 1987 banquet featured the first-ever report of the Peter I Island trip. Informal hospitality suites run into the early morning hours, before bleary-eyed DXers arise for the Sunday morning brunch and another major DXpedition presentation. Around noon the gang breaks up for the long drive home.

The Grosvenor Holiday Inn in Visalia, site of the convention, books up very early. The Holiday Inn 800 telephone number simply reports that the hotel is booked, but DXers can reserve rooms as late as January by calling the hotel direct at 800/821-1127 9–3pm Pacific time. Registration for the 1988 convention is $44, including the banquet and brunch, via Don Bostrom N6IC, 4447 Atol Ave., Sherman Oaks, CA 91423, or at the door.

Dayton

Although not a pure DX convention, the Dayton Hamvention attracts more DXers to a single spot than any other event. DXers try to stay at the Stouffers 513/224-0800, but you practically have to reserve next year's room as you check out this year to be assured of a bed.

In addition to all the fancy DX equipment, the huge flea market, and all the other booths at the Hara Arena, DXers can now enjoy a Friday night dinner at the Stouffers, sponsored by the Southwest Ohio DX Association. Previous dinner speakers include Lee Wical KH6BZF and Bob Locher W9KNI. Saturday everyone goes to the arena for the contest forum and the DX forum, which last most of the day. The DX forum includes DXpedition reports, technical talks, and DXCC and DXAC news. The 1987 forum featured, among others, LA2GV on Peter I island, the Colvins, the XF4DX trip, and W3AZD on DXCC.

On Saturday night, many major DX clubs sponsor hospitality suites at the Stouffers, which feature videotapes, slide shows, CW-copying contests, and comraderie. Sign-up sheets at the doors to these suites read like the Who's Who of DX, including dozens of DXers from every corner of the globe. Among the best suites are those of the Southeastern DX Club and the Kansas City DX Club. The Mad River Contest Club, Yankee Clipper Contest Club, Canadian DX Association, and the Long Island DX Association have also hosted suites in past years.

"The (British Columbia) DX gang provides some of the best hospitality anywhere, in one of the world's most attractive cities."

The 1988 Dayton Hamvention is April 28–May 1. Registration is $8 to Box 2205, Dayton OH 45401. The DX Dinner will be Friday, April 29 at the Stouffers. Cost is $20 and reservations must be made in advance to Jay Slough K4ZLE, 8183 Woodward Drive, West Chester OH 45069.

Northwestern DX Convention

After the two consecutive weekends of Visalia and Dayton, the DX convention-goer needs time to recuperate. Fortunately, the next DX convention is not until the fourth weekend in July. The Northwestern DX convention rotates between Portland, Oregon, (Willamette Valley DX Club), Seattle, Washington, (Western Washington DX Club) and Vancouver, British Columbia (British Columbia DX Club). The 1988 convention will be in Vancouver, where the BC DX gang provides some of the best hospitality anywhere, in one of the world's most attractive cities.

DXPO

DXPO alternates between Washington DX (North Capitol DX Association) and Atlanta, GA, (Southeastern DX Club.) Typically held in early Fall, DXPO features a full day of speakers and seminars on Saturday, followed by a banquet presentation. Sunday morning brunch wraps up the weekend of activities. DXPO 88 will be held in the Washington, DC, area.

W9DXCC Meeting

Another Fall DX gathering is the W9DXCC meeting, sponsored by the Northern Illinois DX Association, held in theChicago area in Mid-September (Sept. 17th in 1988.) This well-run affair starts with hospitality suites Friday night, and features a jam-packed program all day Saturday. 1987 program topics included packet radio in DX, 75 meter yagis, Peter I Island, PRB-1 update, ARRL Forum, VP2ML, and Ms. Bharathi VU2RBI on the VU4APR Andamans DXpedition. In addition to the banquet speaker (K9AJ on XF4DX in 1987), the evening includes the presentation of the DX Hog of the Year Award, a somewhat dubious honor whose symbol is a gold-painted pig on a trashcan lid.

The opportunity to share DX experiences and learn from more accomplished DXers is another unique element of these events. Why not attend one in 1988? ■

Number 32 on your Feedback card

FUN!

Ham Radio's Lighter Side

John Edwards KI2U
PO Box 956
Mt. Laurel NJ 08054

FUN POLL: How Hams View Themselves

The results are in! From Lawrence Welk Village to Sun City to RV parks nationwide, hams have made their views known.

Yes, the results to the December '87 poll are here. As usual, loyal FUN! fans responded by the thousands to the approximately annual FUN! Poll.

Read 'em and enjoy.

ELEMENT 1—BACKGROUND

1) Sex:
A) Male-97%
B) Female-3%

2) Age:
A) 15 or below-1%
B) 16-21-3%
C) 22-39-31%
D) 40-59-42%
E) 60 or above-22%

3) License class:
A) Novice-3%
B) Technician-19%
C) General-17%
D) Advanced-33%
E) Extra-28%

4) Number ol years licensed:
A) 1 year or less-9%
B) 1-5 years-14%
C) 6-10 years-13%
D) 11-20 years-17%
E) 21 years and up-47%

5) Do you have a new (post-March) '78 call?
A) Yes-51%
B) No-49%

6) How many hours a week do you devote to amateur radio?
A) 0-1 hours-12%
B) 2-5 hours-36%
C) 6-10 hours-28%
D) 11-20 hours-17%
E) 21 hours or more-7%

7) Which HF band do you use most?
A) 80-75 meters-18%
B) 40 meters-21%
C) 20 meters-21%
D) 15 and/or 10 meters-25%
E) Don't operate HF-15%

8) Which VHF/UHF band do you use most?
A) 6 meters-3%
B) 2 meters-82%
C) 220 MHz-2%
D) Higher frequencies-3%
E) Don't operate VHF/UHF-10%

9) Which mode do you use most?
A) SSB-32%
B) CW-28%
C) FM-30%
D) RTTY-6%
E) Other-4%

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues and other incidental expenses.)
A) $0-$250-30%
B) $251-$500-20%
C) $501-$1,000-22%
D) $1,001-$2,500-18%
E) $2,501 and up-10%

ELEMENT 2—SOCIAL CHARACTERISTICS

11) On the whole, hams are:
A) Too young-2%
B) Too old-60%
C) Just the right age-38%

12) Do you like rock music?
A) Yes-44%
B) No-56%

13) Politically, how would you define yourself?
A) Conservative-58%
B) Middle-of-the-road-32%
C) Liberal-10%

14) Should we get rid of the ARRL?
A) Yes-4%
B) No-96%

15) How old were you when you first became a ham?
A) 15 or below-35%
B) 16-21-20%
C) 22-39-20%
D) 40-59-20%
E) 60 or above-5%

16) Should the FCC increase the speeds on amateur CW examination?
A) Yes-5%
B) No-95%

17) Do you own a home computer?
A) Yes-80%
B) No-20%

18) If you answered "yes" to question 17, which brand?
A) Apple-20%
B) IBM-20%
C) Radio Shack-5%
D) Commodore-45%
E) Other-10%

19) Do you think that home computing is siphoning people (including youngsters) away from amateur radio?
A) Yes-50%
B) No-50%

20) Are hams getting dumber?
A) Yes-40%
B) No-60%

21) Do business interests deserve some of our virtually abandoned bands?
A) Yes-25%
B) No-75%

22) Should ham licenses have a minimum age requirement?
A) Yes-5%
B) No-95%

23) Should ham licenses have a maximum age requirement?
A) Yes-4%
B) No-96%

24) Should hams be subject to periodic retesting?
A) Yes-28%
B) No-72%

ELEMENT 3—OPERATING HABITS

25) It the users were restricted to data communication only (no phone or CW operation), would you be in favor of a no-code 220 MHz Digital-class license?
A) Yes-64%
B) No-36%

26) Would you be in favor of such a no-code 220 MHz Digital-class ticket it it permitted phone operation in addition to data transmission?
A) Yes-44%
B) No-56%

27) Have you ever used a personal computer in connection with your amateur radio activities?
A) Yes-80%
B) No-20%

28) Is it time to completely deregulate amateur radio by having the FCC turn over all responsibility tor ham operation to the amateur community?
A) Yes-12%
B) No-88%

29) What do you think of CW keyboards?
A) Love them-44%
B) Hate them-56%

30) Should we get rid of, or reduce in size, the CW bands?
A) Yes-20%
B) No-80%

31) Do you think DX nets have a place in ham radio?
A) Yes-92%
B) No-8%

32) Do you think nets in general have a place in ham radio?
A) Yes-96%
B) No-4%

33) The next time a ham operates from space, which band should he/she use?
A) 2 meters-60%
B) 220 MHz-16%
C) 450 MHz-16%
D) An even higher band-8%
E) Shouldn't bother to operate-0%

34) If, while tuning across a band, you heard a net called "Jammers International" in progress, would you:
A) Jam it-0%
B) Ignore it-56%
C) Complain to the FCC orsome other organization-12%
D) Listen-32%
E) Join it-0%

35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes-60%
B) No-40%

36) If required, could you pass the FCC theory test for your license class?
A) Yes-90%
B) No-10%

37) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes-10%
B) No-90%

38) Are you fluent in any computer language?
A) Yes-80%
B) No-20%

39) If you answered "yes" to question 38, which language?
A) BASIC-43%
B) Pascal-9%
C) Assembler-14%
D) Machine-14%
E) Other-20%

40) Do you feel yourself competent to write a short BASIC program?
A) Yes-60%
B) No-40%

41) Do you feel yourself competenl to replace the finals in a transistor-type rig?
A) Yes-92
B) No-8

42) Do you solder together your own coax connectors?
A) Yes-96%
B) No-4%

43) Do you smoke while operating?
A) Yes-20%
B) No-80%

44) Do you operate a packet radio system?
A) Yes-30%
B) No-70%

45) What do you think of contesting?
A) Great-16%
B) Good-28%
C) Okay-36%
D) Don't like it-16%
E) Despise it-4%

46) What do you think of DXing?
A) Great-24%
B) Good-40%
C) Okay-32%
D) Don't like it-4%
E) Despise it-0%

47) What do you think of repeaters?
A) Great-60%
B) Good-28%
C) Okay-6%
D) Don't like them-0%
E) Despise them-4%

48) What do you think of traffic handling?
A) Great-44%
B) Good-12%
C) Okay-32%
D) Don't like it-8%
E) Despise it-4%

49) If you heard an emergency net in progress, would you immediately join in and offer your services?
A) Yes-58%
B) No-42%

50) Have you ever secretly hoped for a minor disaster to strike your community so you can demonstrate your radio skills?
A) Yes-12%
B) No-88%

Number 35 on your Feedback card

73 INTERNATIONAL

Edited by Richard Phenix

Notes from FN42

새해를 맞이하여 행운과 만수무강을 빕니다

May the New Year

Bring you a Basketful of Happiness and Joy!

We're off to a good start on the task of untangling the whats, whys, and wherefores of applications for permits to operate in countries other than your own. In the box you will find the headings Change, Comments, and Special Requirements. Under the first will be changes to make on the application form published in January on page 78. (If you don't have this, send us an SASE and ask for a copy.)

These result from suggestions received, which seem to be best for a maximum number of countries and hams. The "comments" will include suggestions which seem to make a lot of sense but may not conform to the present requirements of most countries. If you agree with any, it is up to you to work with your country's officials to modify any requirements you believe could be changed. Keep us informed.

Reports from SV1IW and XE1MKT next month. (New address for Mark Toutjian: Apartado Postal 311, 56101 Texcoco, Mexico.)

Events in March for you to use when greeting hams around the world: Independence Days will be celebrated in Morocco (3rd), Ghana (6th), Tunisia (20th), Greece (25th), and Bangladesh (26th); National Days: Sudan (Unity)—3, Syrian—8, Tibet—10, Grenada—13, and Malta—31. March 1—Heroes Day, Paraguay; 2—Peasants Day, Burma; 6—International Womans Day, USSR; 9—Decoration Day, Liberia; 10—Labor Day, South Korea; 12—Commonwealth Day, Swaziland; 13—Mother's Day, Great Britain, which has its Commonwealth Day on the 14th; 17—St. Patrick's Day, Ireland and USA; 21—Vernal Equinox Day, celebrated in Japan; 23—Pakistan Day; 27—Armed Forces Day, Burma; 28—British Evacuation Day, Libya; 29—Youth Day in Taiwan.

COMMENTS

Brazil: Does not require equipment data, band, or emission info; grants highest class of license in Brazil to any class of licensee from reciprocal country; expiration date is expiration date of your license or last day of stay in Brazil. From PY1APS. Israel: Our permit fee is US$10. New streamlined process being developed now. Details will follow. Suggest the Universal form provide spaces for only those items universally required, and that all additional requirements be given in a numbered list keyed to the country(ies) to which they apply. From 4X1MK. *[Good thinking!—Ed.]*

Republic of China (Taiwan): No reciprocal agreements, but on a one-time, temporary basis, an individual ham will be "welcomed to operate in the station BV2A/BV2B in my presence...with own callsign/BV, or act as my second operator." (Send him a photocopy of your license.) Expedition groups, however, could use the "universal" form (send two months in advance) to the authorities with a list of operators and detailed data on each piece of equipment. From Tim Chen BV2A/BV2B, PO Box 30-547, Taipei, Taiwan, Republic of China. *[See Tim's column, below.—Ed]*

SPECIAL REQUIREMENTS

New Zealand: Description of self: Height; color of eyes and hair; complexion. No fee for reciprocal country's hams. Novice class licenses DO NOT qualify. Send application to *Post Office Headquarters, Wellington, NZ.* From ZL2VR. *[NZ's form and process very simple, straightforward, and fast, but Novices had better upgrade!—Ed]*

UNIVERSAL PERMIT APPLICATION
(Refer to Application form in January issue, p. 78)
CHANGES

Add: Submit 3 copies of application. And from CT4UE, who also thinks this a good idea, the first point should be: (1)The rules of Radio Amateur Regulations in force in the country of operation. (The present points now become 2 through 5.)

Delete: (No deletions yet.)

Change: (No changes yet, but see Comments.)

"May the New Year Bring you a Basketful of Happiness and Joy!" *Byong Joo Cho HL5AP*

Roundup

Australia. Details next month; Australia celebrates its Bicentenary this year. VK4MU (WIA Queensland Division Secretary) reports much confusion at EXPO and acres of red tape, but VK4QA is hopeful that VI88XPO will be heard between April 30 and October 30. VI88QLD will be heard all year, and Australian hams are allowed to use the special prefix, AX. VK3YJ reports that the radio club, Polonia (VK3CRP), using VI88, was active January 4 to March 4. (QSL Manager at PO Box 2376, Richmond South, Victoria, 3121 Australia; send SAE and two IRCs.)

For the fourth month running, an interesting emergency-at-sea story from Norfolk Island's VK9NL will have to be held over! The event happened in July, 1987, and involved some good hamming by John VK9JA, Norfolk Island officials, and the Royal Australian Navy's *HMS Whyalla*. Keep watching for it!

Canada. "Life is being in the right place at the right time," says Beverley Oda, a Japanese-Canadian recently appointed to the Canadian Radio-Television Telecommunications Commission. She sees her position as an opportunity to advocate her lifelong interest in multicultural TV. (From *World Press Review*, 1/88.)

Ecuador. Last October, the Guayaquil Radio Club sponsored the second annual International DX-HC Middle of the World Contest "to tighten the friendship between the HC and the rest of the world's ham radio operators." Winners of the 1986 contest (1st, 2nd, and 3rd place) were: 40m—Victor H. Botero A. HK5ISX/N, Bernardo E. Delgado HJ8MPU, Jairo Vargas S. HJ5MQZ; 20m—Jimmy Alonso S. TI2TWR, Ricardo Munoz H. XE1AFQ, Leonor Shamah HP1XLI; Multiband—George A. Padron YV1CLM, Jesus A. Ustariz HK2DBC, Francisco G. Caparroz HR1FC. For 1988 rules write the club at PO Box 5757, Guayaquil, Ecuador.

USSR. Excerpts from *Perestroika*, the recent book by Soviet Communist Party General Secretary Mikhail Gorbachev, suggest that his stated policy of *glasnost* (openness) could herald relaxed policies in ham radio matters.

Stating that the USSR is "a unique community of more than 100 nations and nationalities...for 280 million people on a territory forming one-sixth of the earth." The USSR encountered serious difficulties in the 1970s. To solve these problems, " the only logical conclusion [which was] announced at the April 1985 Plenary Meeting of the Central Committee, which inaugurated the new strategy of *perestroika*....

"*Perestroika* is a revolution [requiring] the demolition of all that is obsolete, stagnant and hinders progress." To Western eyes those words clearly spell out "more communication, more sharing of ideas, views, and thoughts." Time will tell if the words meant the same to Mr. Gorbachev. Watch this column for a red flag with hammer and sickle and a Russian correspondent! (Quotes taken from "The World According to Gorbachev," *Washington Post National Weekly Edition*, 12/21/87.)

[See also under Israel, below.

—Ed.]

CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

C4LWF, the special Limassol Wine Festival station, did not operate last September due to lack of support from the organizers, and for the same reason about 300 QSL cards and certificates from the 1986 operation cannot be dispatched. From June through December the Cyprus Amateur Society did have authorization to use the H25 special prefix to celebrate its 25th anniversary. As far as I know, it was used by 5B4SA, SC, QA, and JE.

The number of Cyprus amateurs seems to be increasing, but the really active ones do not exceed the dozen mark. Avid DXers are Laurence 5B4SA, Mike -TI, Akis -OA, Phidias -OK, Christos -QA, and myself. The club stations in the main cities are getting organized and all of them now have a tribander (present from CARS) and are activated at least once a week. In response to inquiries from abroad about top band activity: as far as I know, the only SSB on 160m is 5B4OA; most of our DXers are active on 80 and 40 from time to time. The ZC4 stations at the British bases are quite active, especially on CW. Number 1 DX chaser, active on all bands, is Adrian ZC4AP. Others include Dave -DR, Ian -IM, Alan -AB, and Nick -EE. Last October ZC4DX was operated from the Episkopi base club station by ZC4AP, -SA, Spyros -MF, and Dov 4Z4DX for the WPX contest.

Of great interest to VHFers is long-distance communication via sporadic E. Undoubtedly Nick 5B4AZ is number 1 with this—a real hounddog in smelling out the openings. Last June he again worked about 10 Italian stations, and for the first time a French station using an FT-2900 and telescopic whip antenna. During the first week in June several 5B4 stations are listening and calling on 144.3 MHz—VHFers be alert and stretch your ears!

Nick 5B4CV is our only serious SSTVer. He was first in Cyprus and 5th worldwide in the 1987 SSTV contest. Nick plans to homebrew some color converter now.

CZECHOSLOVAKIA

Rudolf (Rudy) Karaba OK3CMZ
(OK3KFO ARC)
Gogol'ova 1882
955 01 Topol'cany
Czechoslovakia

•Every December, the Minister of Telecommunications in Prague announces the best and most active radioamateurs. In 1986, on the occasion of the 35th Anniversary of the Military and Sports Association, he awarded honors to the best radioamateurs and gave some of them the title, Master of Sports.

•1986 shortwave champions (the biggest world and local contests), with 75 being the maximum points possible, were OK6RA (operator OK2FD) with 69 points, and OK1VD and OK1DBM each with 66 points; for collective stations: OK5W (OK1KSO) with 75 points, OK3KAG, 69, and OK1KQJ with 50.

•Sarajevo, Yugoslavia, hosted the 3rd World Championships of Radio Orientation Races in September of 1986. Some 1200 contestants came from Austria, Bulgaria, Belgium, Czechoslovakia, China, Japan, North Korea, South Korea, Hungary, Norway, Poland, Romania, Sweden, Switzerland, and Yugoslavia. In very difficult competitions, Czechoslovakia won six medals, three of them gold.

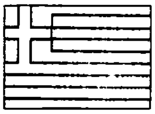
•That December, Engineer Jaroslav Losinsky, Deputy Minister of Telecommunications, announced that beginning in January, 1987, the 18- and 24-MHz bands would be freed for Czechoslovak amateurs; there were other changes also: 18.068–18.168 kHz and 24.890–24.990 kHz—operation mode A1, A3, A5; the bands 1.75 and 1.95 MHz changed to segments 1.810 to 2.0 MHz. Input of 500 watts maximum 1.810 to 1.850, and 15 watts 1.850 to 2.0.

Stefan OK3CGP and his 1984 ARRL International DX Contest award, QRP category.

•Since February 2nd of last year, from Monday through Friday at 0605 and 2305 UTC Czech amateurs have been able to tune in on the commercial station, Star, to get a forecast of propagation of electromagnetic waves (relative number of solar spots, solar radium flow, and data on geomagnetic index A_k).

•Every November from the 1st to the 15th, there is a contest on behalf of Czechoslovak/Russian friendship. I will report the winners of this year's event to you.

•Orbital Station MIR is not a radio amateur satellite, but in the future Soviet cosmonauts will be heard from. The station callsign will be U1MIR; it will operate FM on 145,000 and 574 MHz with a 5-watt output and a multidirectional antenna; the inclination of MIR's orbit is only slightly different from that of the FO12 satellite. The 5-watt output will be sufficient for Earth stations, antenna with 10 decibels gain and a receiver with sensitiveness of 0.5 microvolts.



GREECE

Manos Darkadakis SV1IW
Box 23051
11210 Athens
Greece

[SV1IW writes that the Technical University of Athens is not at the address given in last November's International Roundup item on Dr. Agis Sarakinos. Quite right! Apologies to that institution for moving it into SV1ACS's own space.—Ed.]

Up until now you needed to be a member of the one and only International Amateur Radio Union (RAAG) before you could get an amateur license in Greece. Well, as this is written [October, 1987] a change has been sent to the Parliament so that you do not have to be a member. I personally think that is more fair. I have also some information that a new club is going to see the light of day here in Athens, of people who have a common love of Specialized Communications. I guess that means FAX, ATV, Packet, and maybe more.

Speaking of packet, here in Athens, where there are about ten people capable of this mode, we are trying to organize the first Greek LAN. This is most difficult because the people have just one computer working on a time-sharing basis for a lot of things, packet being one.

I hope that with the evaluation of a German-made program for the popular C-64 computer things will change, as this excellent program does a software emulation of a TNC and needs only a small modem board like the one with the AM7910 chip in ARRL's *Handbook* for example. If we raise some activity with it, there is a small PBBS program and maildrop to further promote interest and more activity. I would appreciate hearing from others, anywhere in the world, where packet activity is slow, with ideas and suggestions. We are short of literature covering updates and mods and improvements on popular TNCs.

Our RO repeater is still out of order, and as we are at winter's front door there is no hope it can be repaired before the snows. This is the one with its own onboard computer to check its functions, but this is proving to be the main disadvantage as only one person can repair it. It's been off for nearly a year now—a great inconvenience in this mountainous country.

ISRAEL

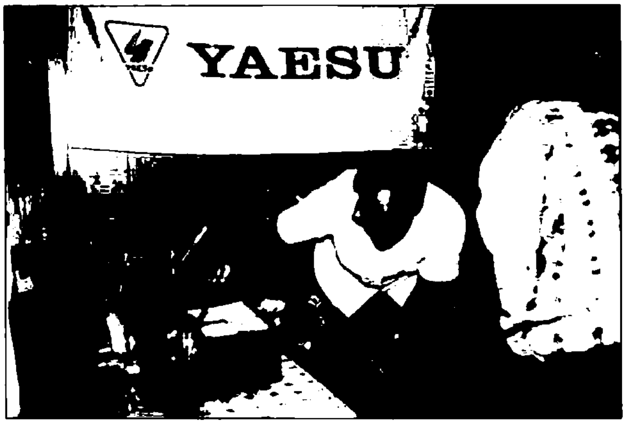
Ron Gang 4X1MK
Kibbutz Urim
Negev M.P.O. 85530
Israel

[Note that Ron 4Z4MK is now 4X1MK!—The rules of, and suggested log sheet for, the April contest honoring the 40th anniversary of Israel's independence, mentioned briefly last month, now may be obtained from us. US hams: send an SASE with your request.—Ed]

Novice Enhancement. Principle agreement has been reached between the Ministry of Communications and the Israel Amateur Radio Club to grant voice privileges to Grade C (Novice) li-

portion of the Grade B (General) class exam dealing with regulations and on-the-air operating will be added to the Novice exam and must be passed before present Novices can operate voice.

The Novice license is renewable, and presently allows 15W output on CW only between 7.000 and 7.050 MHz and 21.100 and 21.150 MHz. The exam consists of a 6-wpm code test and a theory portion similar in scope to the US Novice test. Those passing are given a 4Z9 call with a three-letter suffix. Previously, a Novice could have been 4X4NXX, 4Z4NXX, or 4X6NXX, with the N dropping out once the General exam had been passed. Now the previous prefixes will belong only to Grade B licenses and old Novices will be reissued 4Z9 calls. Grade A licensees are being given the 4X1 prefix, so that for better or worse all callsigns now will indicate class of license.



4Z4ZB, active packeteer and Oscar phase III C operator, checks gear at a hamfest. 4X6LU, right, looks on, and unidentified young ham looks wistfully at "dream" gear.

PL Reminder. The IARC has decided that beginning now all two-meter repeaters in Israel will be accessed only by carriers with a 192.8 Hz subaudible tone added. This has become necessary, unfortunately, because of the proliferation of clandestine signals on the 2m band from north of the border. Visiting hams, who are welcome guests on our repeaters, are reminded to make sure their handies are equipped with a PL tone generator.

The Iron Curtain Rises? Since the Six Day War, Israeli amateurs have been boycotted by the Soviet Union and East Germany—hams from there have been forbidden to work 4X or 4Z stations. In the last few months, however, East German hams have begun to work us freely on all bands at all times, and we were told to QSL via the bureau. Then Yitzhak 4X1FU (formerly 4X4FU) received two parcels of QSL cards from the East German bureau for 4X/4Y. That marked the first time in 20 years that we have had cards from that bureau! We hope that this enlightenment will continue. *[See USSR, under "Roundup," above.—Ed.]*

Packet News. Packet seems to be an accepted fact, with more and more stations getting in on the act. The IARC has allocated 1,000 shekels for enhancing the national network, which can be heard/seen almost around the clock, buzzing away on 144.675 MHz.

Two-meter Band Plan Adopted. With the increasing traffic on two meters, the IARC Executive saw fit to ratify the VHF band plan worked out by 4X4GE and 4X4GI. In accordance with the IARU's Region I spectrum accords, the band's two megahertz are divided so that the first 150 kHz are for CW only, with the addition on SSB up to 144.500. Only from there on up is FM allowed, channelizing the band in 25-kHz steps. 144.600–144.675—packet only; 144.700–144.775—repeater inputs; 144.900–144.990—for beacons; 145.000–145.775—FM simplex and repeater channels; and the top of the band, 145.800 up to 146.000 is reserved for the amateur satellite service exclusively. (144.000–.025—EME spectrum; 144.050—international CW calling frequency; 144.100—meteor scatter; 144.300—international SSB calling; 144.400—SSB meteor scatter.)

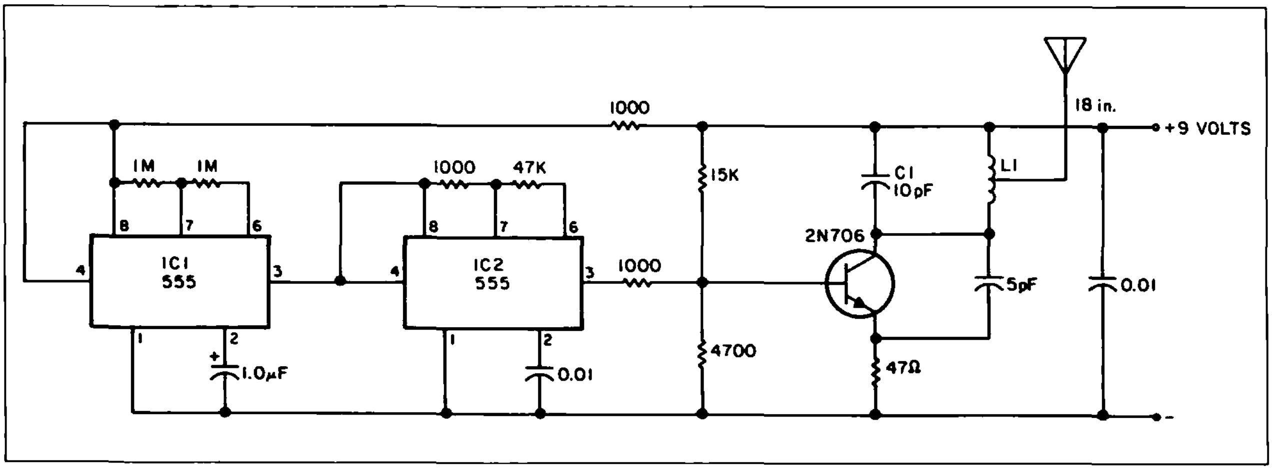
It is hoped that with the publication of this band plan confusion and unintentional interference will cease. Now if we could only bring this to the attention of the clandestine operators north of the border . . . !

Number 29 on your Feedback card

CIRCUITS

Great Ideas From Our Readers

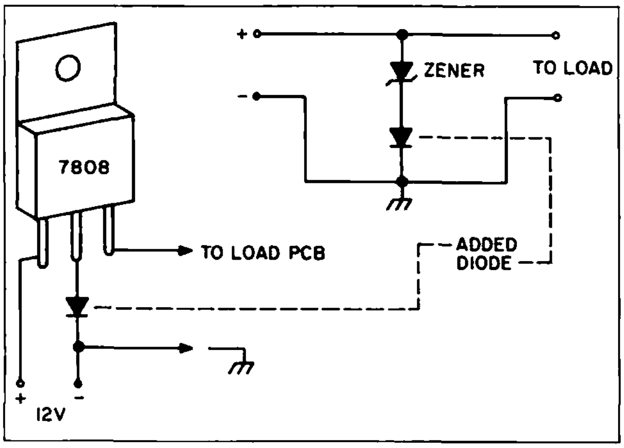
Have a quick'n'easy circuit idea? Share it and get a one year subscription or extension to *73*! Clearly mark all entries as submissions for Circuits to distinguish them from manuscripts. Send your entries to Circuits, 73 Magazine, Peterborough, NH 03458.



BEACON TRANSMITTER

This transmitter can be used for transmitter hunts, as a remote key finder, or radio telemetry (model rockets). It can be tuned to the two meter band or other VHF bands by charging C1 and L1. L1 is 4 turns of #20 enameled wire airwound, ¼" in diameter (use a drill bit), 5mm long center tapped. The antenna can be 18" of any type of wire. IC2 functions as an audio oscillator that is turned on and off by IC1 about once per second. The range of the transmitter is several hundred yards.

James Kretzschmar, N4HCJ
Davis, CA



SIMPLE CONVERTER RECEIVER FOR YOUR VFO

Here is a simple easy-to-build receiver converter that, when used with your station VFO, makes the combination of these two pieces of gear into a simple Direct Conversion Receiver that will tune the 80 and 40 meter amateur bands as well as other shortwave bands for DX shortwave listeners. It will receive CW, SSB, and AM. The inductance and capacity in the antenna input circuit could be changed to receive 20,15,10 and 6 meters.

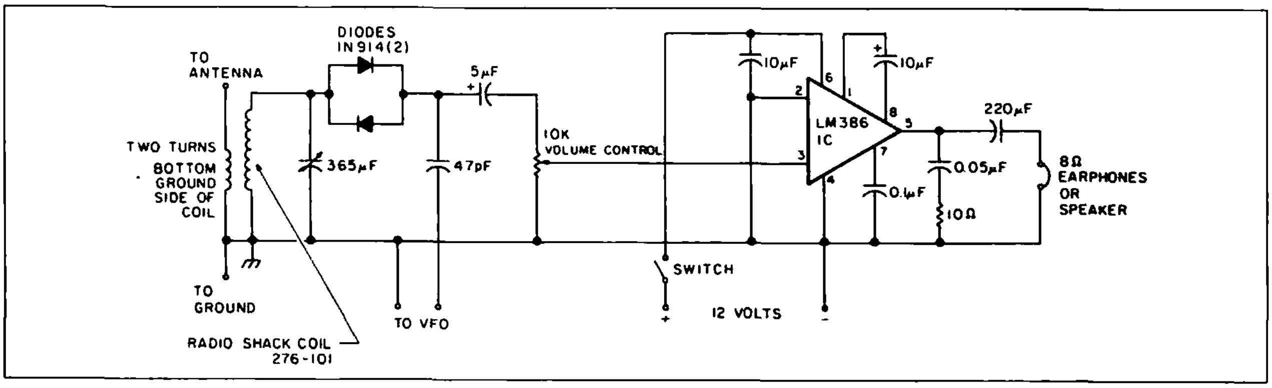
This simple converter can be constructed on a small piece of 2" x 2" PC board using terminal strips to solder parts to and inter connecting to other terminal strips they can be bolted or soldered to the PC board. Make sure the converter-VFO output connections are well-shielded. Happy Soldering.

Kenneth Hand WB2EUF
East Hampton, NY

RECTIFIER DIODE

The project I was making had a Sonalert type buzzer whose operating voltage range was 7 to 12VDC. My PCB was set up for operation at 8V and I put in a 7808 regulator. But when I turned on the power the 7808 only put out 7.5 volts. I felt I needed a better margin for the buzzer than .5V, so I added a rectifier diode (see drawing) and came up with 8.1V. This idea should work as well for zener regulators.

Dick Beckman W7FVM
St. George, UT



Number 36 on your Feedback card

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

The Novice Shall Inherit Ham Radio

I finally found a terrific group of hams. They are everywhere. I talk to them every night on my way home from work. I chat with them on weekends on 10 meters. I meet more and more of them on each business trip. They are warm, friendly—and most important—they are neither stodgy nor steeped in the traditions of the past. The saviors of ham radio have arrived and they carry a bright banner that reads "Enhanced Novice!"

When the ARRL backed the original Novice Enhancement proposal, they likely envisioned that any growth would come mainly from the members of a family where there was already one ham as a member of the household. This happened in many cases. I know a lot of OMs whose wives not only got their ticket, but who are a lot more active than their spouse. There's an increase also. The number of younger people on the air—mainly hams' sons and daughters—also increases. Most seem to be pre-teens, and their interest does not seem to be as much in ham radio as in keeping in touch with mom and dad.

It turns out, however, that these new ops are a minority. Whence the bulk of new ops?

10½ Meters!

Try a little SWLing on the Novice portion of 10 or 220. Listen past the text of a conversation and pay attention to the operating procedure. The new Novice from a ham family is usually shy and mistake-prone. The 10½ meter operators ("HFers" or "Sidebanders"), however, sound like experienced operators who use a strange language. He asks for the "10-20", or just "20", instead of QTH. Goodbye isn't 73, but "Good Numbers". Instead of saying to look for him on the air on his return trip, it's "on the flip-flop." A stop at the filling station is to "get more go juice" and nobody owns a rig, but a "two-way"! That's just a bit of what's been on the Novice voice bands this past year. Yes, this CB lingo has caused many higher class licensees to grumble.

This is only the tip of the iceberg, however, of HFers. More and more active and retired HFers and Sidebanders (HFers from here on) are finding out that with only a 5 wpm code test and a few simple questions, they can do legally what they did illegally for the past two decades!

There are some who believe that the real purpose of Novice Enhancement is to clean up or at least to minimize the amount of illegal activity taking place just above 11 meters and below 10 meters. I doubt that the FCC had this in mind, but it does appear an unexpected side benefit.

Imagine being in the shoes of an illegal HFer. Most of the time, propagation on 10 meters is the same as on 10½ meters. Only a fool would stay where he shouldn't be, when with an evening or two of memorization and a week of CW practice he can have legal call letters. Many HFers are taking the path toward ham radio as a way of self-preservation. In addition, they have access to several other bands. Not a bad deal.

I started doing a bit of research on the potential political clout of HF converts to ham radio. Their numbers astound—most are drawn from mid-70s FCC figures of the legal Class D Citizens Radio service when growth was at its peak. While the FCC estimates that, at its peak, there were upward of 60 million 11-meter Class D CB sets in the hands of the public, licensing figures seemed to peak at about 20 million. CBing went way down during the '70s gasoline crunch, and by 1980 rigs languished in attics, in basements, and on flea-market tables. CB would never become a hobby for the masses since folks use CBs only to find gas and avoid speeding tickets.

The industry estimates that, at the time, about 1% of non-ham personal communications enthusiasts migrated above the 11-meter band. Most found that the ham gear of the day was easily modified to operate in the 10½ meter band, and the population of that spectral parcel grew. At one time, there were over 100,000 known operators on the 10½ meter band! The known operators were the ones listed in the two-volume set of the HF International "Callbook". Norm Mueller, a representative of this company, believes his Callbooks list only half the 10½ meter users. This indicates a peak usership of 250,000 HFers—a quarter million potential Enhanced Novices!

Politically Savvy

Many of these guys and gals have "two wayed" for almost two decades. They are, for the most part, excellent operators. With experience comes political awareness—especially in matters pertaining to ham radio. This is especially evident on the local 220 repeater.

> **"HFers—a quarter million potential Enhanced Novices!"**

The political acumen of the HFer-turned-Enhanced Novice first hit me while on a trip to the San Francisco area early last spring. I had my IC-3AT along and wound up as the first QSO for a guy who had just received his ham ticket an hour earlier. It took him that long to find someone on the air at midday.

The first thing I noted was that he knew who I was. That seemed strange until he explained that he had been listening to my Westlink newscasts since the late '70s when repeaters in San Francisco started to carry them. "Why would he be listening to Westlink if he wasn't a ham," I thought. I didn't have to ask the question. He allowed that he had been an HFer since '72 and would never have gotten a ham license to "just work Morse code".

He said "No" to upgrade plans, but intends to plunge into ham radio politics. He wants to make it easier to get a license by doing away with the code entirely for the Novice, and eventually for all grades of licenses. He also wants to be the first Novice to become an ARRL official—he has his eyes on the Pacific Division Directors chair. He wound up the QSO with this terse and foreboding statement—"Bill, there's power in numbers". He is so right.

I was on the road quite a lot during 1987, mainly as the field producer for "The New World of Amateur Radio" videotape. It wasn't until the ARRL National Convention in Atlanta that I had a chance to monitor the local 220 repeaters. It was mid-Summer and there were already many active Enhanced Novices. I heard a lot of enlightening items and it brought back memories of my QSL a few months earlier back in San Francisco. While Techs through Extras on 2 meters were talking either convention or aches and pains, the Novices on 220 were touching on the future. Imagine which I found more inspiring. I soon outfitted my new car with 220.

It's Fun!

We have a lot of fun. After all these years, it hit me. For the first time in a long, long, long time I was communicating—not just talking to be heard! And the vast majority of those I was talking with were New Novices! Most told me, like the fellow in San Francisco, that they have no immediate plans to upgrade.

The new Novices will probably give the ARRL a try—if the ARRL makes a concerted effort to lure them. If they fail to attract them, however, the new Novice may well divorce himself from the mainstream of the amateur community. They will be ripe for the selection and organization by someone ambitious enough to build a national organization to politically represent their needs, wants, and desires. Dwell on it!

Did you know that Pete Hoover W6ZH, grandson of Herbert Hoover, operated as W6KA from inside the American Red Cross float? He did it on SSB using a Ten-Tec Corsair II in the body of the float as an antenna. Pete also has 2 meters and 220 MHz FM gear on-board. He told me a few weeks back that his order of priority was to work Red Cross allied amateur stations and as many Novices as he could! I get the feeling he's as excited about what's happening as I am.

Happy Anniversary to the Enhanced Novices from those of us who appreciate you and who understand how important you are to the very survival of amateur service . . . de WA6ITF ■

QTH DX

QTH is Iceland

Leon Fletcher N6HYK
274 Webster Dr.
Ben Lomond CA 95005

THE NONESUCH COUNTRY

Iceland (TF) is *not* on the list of the "100 most wanted DX countries," according to the most recent (July 1987) survey by *The DX Bulletin*. Icelandic hams can be found by US operators without too much searching. Some Icelandic stations even come up on some of our DX nets a few times a year.

Thus, as a DX country, Iceland is not particularly *rare* in Webster's meaning of "not frequently found." But as a nation, Iceland is indeed *rare* in the sense of "unusual." Just as starters, consider these records: Iceland leads the world in:

•Having the most VCRs per capita.
•Publishing the most books per capita.
•Reading the most books per capita.
•Having the most tractors per acre.
•Drinking milk.
•Daily protein consumption.

Almost Paradise

Most significant, Iceland tops all nations on the "Physical Quality of Life Index"—a rating system that measures desirability, comfort, ease, education, and other such features.

Since Reagan and Gorbachev met in Iceland in October 1986, the country has not seemed quite as remote and unfamiliar. Just before, during, and after that meeting, the media crammed us with words and pictures of life in what many of us learned—generally as quite a surprise—that:

•Icelanders don't sit around in igloos, bundled up in layers of bear skins, trying to keep warm. Actually, during the winter the average temperature in Iceland is higher than in New York City.
•Icelanders don't live in an isolated existence, deprived of the "finer things of life." They have a highly-rated professional symphony orchestra, a prominent opera company, a university, an extensive educational television system, the second highest daily newspaper circulation in the world, and more.
•Icelanders don't die young; the setting is not that rugged, so they don't have to work so hard at routine existence. Both men and women live longer than the residents of almost any other nation.

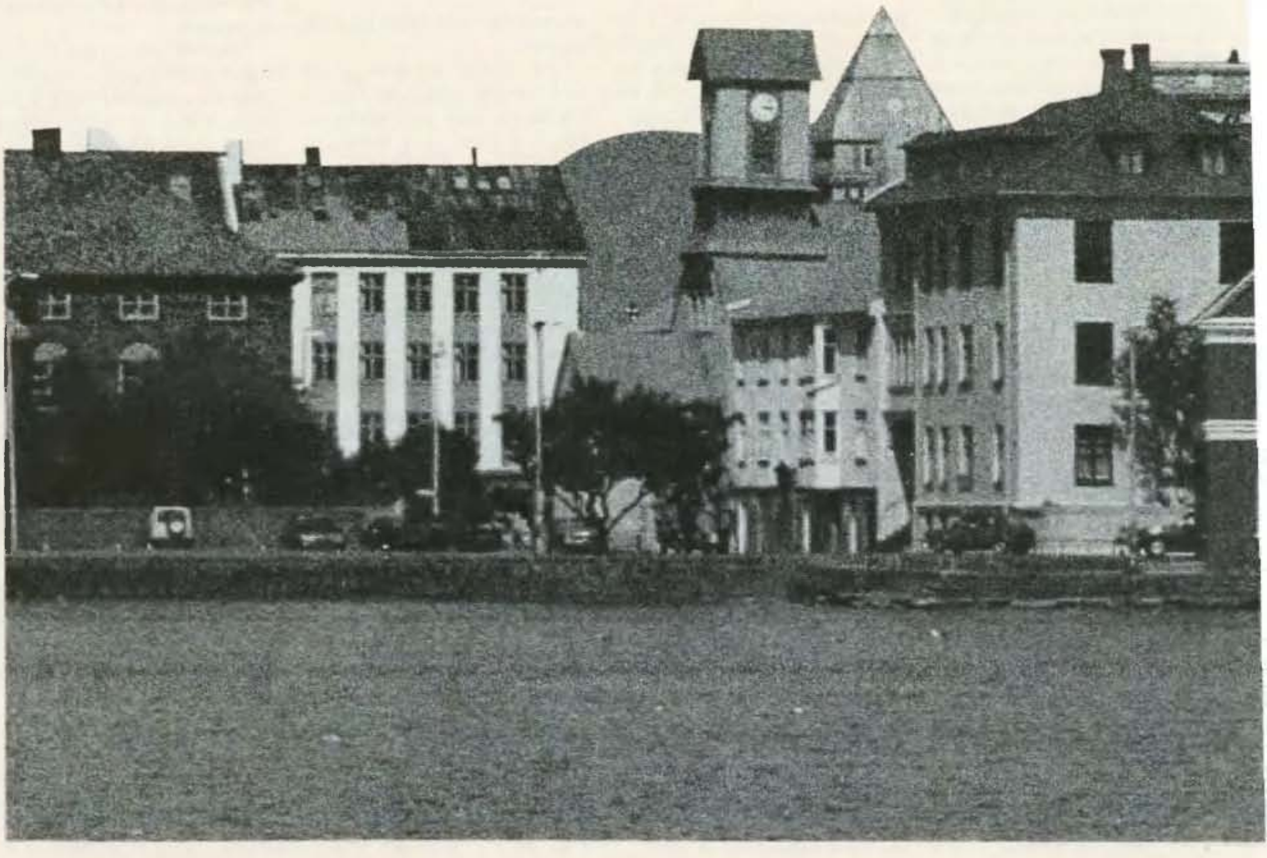
Iceland's literacy rate, at 99.9%, is nearly six percent better than that of the United States. The death rate of infants is 7.1 per 1,000 births; in the United States, it's a shocking 50 percent higher.

Iceland is ruled by the oldest representative assembly in the world, founded in 930, nearly eight-and-a-half centuries before the government of the United States. The President is Vigdis Finnbogadottir, the world's first popularly-elected female Head of State.

There are no trains in Iceland, but the country's two airlines each year carry nearly twice as many passengers as the total population of the country. The new airport terminal, with international flights stopping for rest and refueling, each year handles more than three times the number of residents.

The country's travel brochures describe Iceland as "The Jewel of the North." To back up that claim, they point to such features as:

•Outdoor swimming pools heated by nature for year-round use.
•One of the country's best salmon rivers located within the city limit of the capital
•Pony-trekking as "an ideal way of seeing the country."
•Visiting giant geysers, thundering waterfalls, extensive glaciers, steaming lava fields, etc.
•Sailing clubs, golf courses, skiing, snow-catting, bird watching, and more.



Lay of the Land

Still, thinking of Iceland as a wasteland does have considerable validity. Much of the interior is uninhabited–and unhabitable. Lava fields extend for miles. There are dismal deserts, which are so much like the moon that our astronauts trained there, getting realistic practice in exploring conditions startlingly similar to what they landed on in outer space.

In Iceland has no snakes or reptiles. There are few wild animals of any kind. And all dogs are outlawed in the capital city. try. One of Iceland's glaciers, Vatnajokull, is the largest in Europe, equal in size to all other glaciers in Europe together–as big as Rhode Island and Delaware combined.

Iceland has more hot springs than any other country in the world. Those springs are used to heat all of the homes, offices, stores, and public buildings in Reykjavik, the country's capital and largest city. Boiling-hot water is delivered city-wide through two ten-mile pipelines. As a result the town is completely smokeless.

Backpacking is a popular sport for visitors, but they must carry paraffin or gas stoves for cooking and healing. Since there are virtually no trees, it's illegal to burn the little scrub that exists in only some areas. Because of the lack of lumber, traditional farm houses were built from sod. Today most structures are built of concrete.

Iceland covers 39,769 square miles–slightly less than the size of Virginia, Ohio, or Kentucky. The population is about 250,000–fewer people than in Norfolk, Virginia, St. Paul, Minnesota, or Sacramento, California.

Fortunately for Americans, most Icelanders speak English, as well as Danish and German. The nation's own language, Icelandic, is very difficult—"nigh on impossible" to learn, according to the popular travel writer Eugene Fodor, in his book *Scandinavia*. The pronunciation rules are very hard, but even more difficult is the language's unusual construction—especially the adding of element-after-element to modify a basic concept, resulting in many words stretching on for dozens of letters. Fodor points as an example to the word "haestarettarmalaflutnigsmannsskrifstofustulkuutidyralykill"—it means, he says, "A latch key belonging to a girl working in a lawyer's office." You may not need that line in your conversations in Iceland, but you've got the idea.

TF Hamming

There are 135 hams in Iceland—one for every 1,852 residents, to be compared with about one in every 533 residents of the United States. There are seven different classes of licenses in Iceland:

N–Novice, 50 watts, CW only
A–50 watts, CW, RTTY
B–200 watts, CW, RTTY, SSB
C–500 watts, CW, RTTY, SSB, SSTV
T–50 watts, VHF and above
R–Repeater
S–Club

There are eight club stations, including one at the University of Iceland and one at a Boy Scout Center.

Iceland and the United States have reciprocal operating agreements for hams. If you're interested in awards, a truly beautiful certificate is offered for working Icelandic hams. The number of contacts required is based on a somewhat complex mix of what ITU Zone you live in and on the band and mode of your contact. For full information write to Islenzkir Radioamatorar, Awards Manager, POB 1058, 101 Reykjavik, Iceland.

Photo courtesy of Icelandair

LETTERS

From the Hamshack

HF Emergencies

Congratulations on another fine edition of 73. I found this edition to be one of the most informative yet for the DXer. I would like to offer a constructive comment on Steve Wolf's article "In Praise of DX and WAS Nets". If Steve is looking for dependable emergency communications on the HF bands, he need only tune to *The International Amateur Radio Network*. The IARN is active every day and monitors 10, 20, and 80 meters for emergency traffic. This international network has a proven record for passing emergency, health, and welfare traffic.

He could get in touch either by calling in on net frequency, or if he has a computer and modem, he could contact our Central US Computer Center, "The Cleveland Hamnet" and talk to the SysOp who is David Speltz, KB1PJ. The "HAMNET" is open 24 hours and the telephone number is 216-942-6382. He could also talk to me via "The Circuit Board" BBS, which is the computer center for IARN. The hours for The Circuit Board are 2300–0300 UTC weekdays and 1700–0300 UTC weekends at 207-465-7288.

Jim Sammons N1FID
Assistant Network Manager
for IARN

VE1SH—Silent Key

Ron Hessler VE1SH died a few weeks ago—another smoking fatality. My age too. Though I'd never met Ron, we'd corresponded frequently over the last couple years. Developed quite a friendship.

I was looking back over Ron's letters with the idea of doing an obit which would list his many accomplishments. But the list is so long that it's overwhelming. Ron got started in amateur radio about the same time I did—almost 50 years ago. He became the Canadian ARRL Director and then founded the Canadian Radio Relay League (CRRL).

Ron was an outstanding businessman—I think you'll find his perspective interesting. Here's the last letter I received from him.
—Wayne

In answer to your question as to the health of ham radio in Canada—all I can tell you is that, as in many other matters, we closely parallel the States. Far as I can see, no real difference and we don't even have incentive licensing for an excuse! Our average age group is 55 and, like yourself, we are not getting the youngsters any longer.

I agree *completely* with you but I just cannot see how we are going to awaken our "leaders" into at least trying to do something about the situation. They *all* seem to pay lip service to the urgent need to get youngster back into the service . . . But, nothing happens. No programs—not even on the agendas of most meetings. And, when it is, all that seems to happen is to duly recognize the problem. Radio club meetings are attended mainly by Senior Citizens and they just don't want to be hassled into anything . . . mainly concerned about when the coffee and doughnuts are going to be served!

The recent CARF/CRRL/DOC Symposium was so important that DOC didn't even bother showing up! A complete waste of time and money and I have not been hesitant about informing all and sundry what I thought about it before and after the fact. A pile of unadulterated crap!

Back when these symposiums first started, they were very well attended and quite a few things accomplished. However, due to the ever-changing officials in CARF/CRRL/DOC, the symposiums have degenerated not even worth the money or effort. I hear that the attendance, at this Winnipeg meeting, was under 50. 'Course, what do they expect, when they hold these symposiums in a remote and hard to access place like Winnipeg?

As I have told our CRRL President (little good it will do) what we should endeavor to convene is a symposium with but one single subject and I don't have to tell you what that is? But no, he is so busy with more important things as trying to coordinate the amateur communications on the forthcoming Russian Canadian TransPolar ski trek.

ARRL? No, quite frankly, I have seen absolutely no sign/indication of direction as you call it. I have been extremely busy just trying to get QST to include, in the silent key column, the obit of a personal friend of mine (VE1EE) who passed away last December. After much blood, sweat and tears, buck passing between ARRL and CRRL plus much name calling, etc., I have now been assured by Mr. Sumner personally, that the obit will be in the October issue. You just wouldn't believe, Wayne, the bureaucracy I ran into. However, perhaps the installation of their new IBM System/38 Computer ($419,000.00) will solve all this. And, perhaps it will be smart enough, at this price (no pun intended), to give some direction?

Now I got a bone to pick with you. You have been bugging me to give up smoking. Well, I did, cold turkey a month ago and have never been in such ill health, as a result, ever since. Terrible cough, all kinds of anti-biotics and narcotic type cough medicines prescribed by the vet, followed by, three days ago, a complete loss of my voice. Methinks I had better cure myself and go back on the weed again. Which, as I told Eileen, if everything does not clear up, in another week, is exactly what I am gonna do!

Because, apart from any other reason, my ham activity is now confined to CW. I never liked CW before, but now in my present circumstances, I think it is golden. At least—better than nothing or just being confined to being a SWL?

In answer to your closing question...I constantly am trying to *cause* events; however, I don't seem to be doing any better than you!

Ron J. Hesler VE1SH
Sackville NB EOA 3CO

Ron did more than any other Canadian to promote amateur radio in Canada. I'm going to miss him. *—Wayne*

Kudos

I continue to enjoy my subscription to *73* and especially your editorials which always express excellent and insightful opinions about our hobby. I think you do a good job in covering most, If not all, aspects of the hobby to be appealing to the widest audience.

Finally got my rig back on the air in October and have had a great time working DX. So far, 73 countries worked toward the DX Dynasty Award. I earned DXCC back in 1969 from Wisconsin. Since my gear is now over 20 years old, I'm looking to upgrade to either IC-761 or TS-940. I noticed you went with the 761.

I followed your suggestion on keeping a more detailed notebook on my contacts which is a great idea. It is interesting to note that although there have been great technical advancements in ham equipment over the past 20 years, the basic content of the typical QSO is essentially unchanged. I've tried to interject some personal information into my contacts, such as "Age 38, Ham for 26 years".

January issue was tremendous with all the DX articles! I really enjoy the human interest and operating articles about the Colvins (whom I've contacted), and Jay O'Brien W6GO. It's interesting to me to read about their backgrounds. We have a very diverse crowd in ham radio, even though many are retired. That's what makes our hobby fun!

Incidentally, I really look forward to the DX column each month and have also subscribed to the DX Bulletin. Chod Harris does a great job with both and I enjoyed talking with him the other day when I phoned in my DX report. With a simple HF6V ground mounted vertical and a 22-year-old rig, I need all the help I can get! I'm hoping to get an opportunity to join a DXpedition, or make a visit to Chod's "The Last Resort" on Montserrat. Talk about fun!

I'll be looking forward for W2NSD. Keep up the excellent work. It's a fine magazine and really enhances my enjoyment of our hobby.

Joe Matt WA9AQE
Pittsburgh PA 15237

Thanks for taking the time to write—it's really appreciated.

You know, it's a funny thing, but when I'm on the air a high percentage of the chaps I contact, being aware of who I am, treat me like a DX op and try to sign off as quickly as possible. I often have to almost tie them hand and foot to get 'em to talk with me. I don't get my kicks from filling a log page—I'm there to meet people and hopefully turn them into friends I can rap with when we meet again on the air or at a hamfest.

On the air I try to find out the other person's interests or business so I can ask questions—being interested in almost everything. Hells bells, there's got to be some benefit to having read a few thousand books and tens of thousands of magazines . . . right?

Re my editorials—I don't want to put too many readers on mental overload, so I've been taking it easy.

See you on 20—or Dayton, whichever comes first. *—Wayne*

Number 39 on your Feedback card

OP-ED

by Larry Ledlow, Jr. NA5E

Return of the Living Dead

Novice Enhancement celebrates its first birthday this month, an event worth noting even if you're not a Novice. The full count isn't in yet, but certainly the expanded privileges had an impact on growth. W5YI recently reported a net increase of more than 9100 US amateurs, nearly all of whom were Novice and Technician licensees, during the 12 month period ending in October 1987. Remember that Novice Enhancement only took effect in late March last year, so the reporting period only covers seven months with the new privileges.

The overall US ham census grew nearly three percent. In fact, the Novice and Technician population grew more than six percent. Is that good or bad?

I know a lot of folks will look at the percentages, then roll their eyes back and moan, "Big deal!" Frankly, though, the numbers are neither good nor bad; they're significant. They tell us *something*, but not everything.

I look at the FCC licensing numbers every month. Spring's Novice Enhancement brought an enormous increase of new license applications. So much of an increase, in fact, the FCC couldn't keep up, and license processing delays were 90 days or more! During the summer, the numbers fell off. After all, people have other things on their minds during summer, and most license courses only run during the spring and fall. The numbers were a little sluggish in October (about 750 new Novices), but November brought about 1100 Novice applications, a 42 percent increase over October. Most Novice courses finish in November and December, so new applications are understandably greater.

Even with incomplete data, it's pretty clear that Novice Enhancement has had a positive impact on amateur radio growth in this country. It was an important step forward, but was it enough?

Re-thinking No-Code

Five years ago I wrote a rather exhaustive argument to the FCC *against* the no-code license proposal. A lot of other hams wrote similar arguments, and the Commission killed the no-code license "forever."

Yet the idea persists. I regularly get mail from readers debating the no-code license. Fred Maia W5YI has recently discussed no-code licensing in his bi-weekly newsletter. His readers' comments clearly show strong interest in such a license. Even our "Fun!" poll results show nearly *half* of the respondents favor no-code. The general idea is not dead by any means in the minds of most hams, and I think it's time to reexamine the no-code license.

> **"It's fallacious to argue in favor of Morse code as an artificial barrier to keep the riff-raff out."**

I believe the single greatest impediment to growth in American amateur radio is the Morse code requirement. Whether real or imagined (I actually believe the latter), the difficulties most would-be hams face with Morse code are serious, and more often than not insurmountable, obstacles. Virtually everyone except for about 0.02% of the general population with certain learning disabilities can learn Morse code. The majority of would-be hams who "cannot" learn it fail, because they suffer from poor study habits, or simply psyche themselves out against the code.

Others throw in the towel long before they even try. Many people don't even attempt to learn code, because they feel amateur radio doesn't offer enough to motivate them to overcome the obstacle. "Why should I?" is a perfectly good question.

Most arguments against a no-code license class in this country usually involve the words "tradition" and/or "like CB." There's something to be said about the tradition of Morse code in our hobby. Then again, strong ties to tradition can be detrimental to modernization and growth. Many, many hams are afraid a no-code license will "open the gates" and flood the hobby with a lot of CB-like nonsense.

I am as concerned as anyone about the possibility of uncontrolled growth of amateur radio. Bigger is not necessarily better. Morse code keeps a lot of sleaze bags out of the hobby, but it keeps even more fine people out, too. Even sleaze bags can learn code. Once in a while they do and get a ham license. It's fallacious to argue in favor of Morse code as an artificial barrier to keep the riff-raff out.

The only solid argument against no-code involve international regulations, which specify that HF amateur radio privileges must carry Morse code requirement.

But what about no-code operation on VHF or UHF bands? In England, where I lived for three years before coming to New Hampshire, I saw a very succesful VHF-only no-code license in the UK. The United Kingdom has only two license classes, A and B. Both have the same written exam requirements, but the A Class requires a 12 wpm code test. B Class licensees can operate on any and all ham bands two meters and above. Ham growth in the UK has its own problems centered largely around licensing administration and reluctance to give up "traditions." Basically, however, the B Class VHF no-code license is successful!

We American hams have industry breathing down our backs just waiting to grab a piece of our spectrum, particularly at VHF and UHF. The 220 and 900 MHz bands are under especially serious threats at the moment. Is there a better way to encourage use of those bands than to assign no-code licensees there? HF technology is generally stagnant, but there's lots of potential for development at the VHF, UHF, and microwave bands.

Let's Give It a Shot!

Heck, I say give it a shot. Put together a decent proposal for a no-code license that will encourage growth of the ham population while also encouraging industry to develop and sell the technology for use at higher frequency bands. If one proposal doesn't work out, then try another until it does.

No-code licensing will never die in the hearts and minds of many hams. Perhaps the idea was ahead of its time when the FCC last ruled on it. Certainly I've changed my mind on the issue, and presumably others have done the same. I'd like to see some sensible, far-sighted no-code license proposals go forth to the Commission now.

We have the power to shape our future, so let's do it!

WANTED: Nominations for *73's* 1988 Achievement Awards

At Dayton, *73* Magazine will honor those members of the amateur radio community and industry who have contributed most to encourage the hobby's growth. In particular, we will present awards in the categories of technology and educational advancements during the past year. We will award an individual or club and a commercial venture under each category.

Nominations for the Technology Advancement Award should discuss the nominee's particular contribution(s) to advance amateur radio state-of-the-art. Achievements in circuit design, networking, radio-related computer hardware and software, digital communications, and other areas should be recognized. Industrial awards may also go to a component or equipment manufacturer or other companies that have made particularly innovative technical products for amateur radio use.

The Educational Achievement Awards will honor an individual (or club) and a company who have done the most in the previous year to recruit new hams and/or to educate amateur radio operators.

Nominations should not exceed 500 words, although we will accept additional supporting material, such as photographs, newspaper clippings, advertising copy, and other information. All nominations must be signed. We cannot accept anonymous submissions. Send questions, comments, and nominations to *Achievement Awards, 73 Magazine, WGE Center, Peterborough, NH 03458.* We should receive all material *not later than April 10, 1988.*

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Welcome, Newcomers!

AMATEUR RADIO AND PUBLIC SERVICE

The Amateur Radio Service was created as a public service. Look no further than the first tenet of the Basis and Purpose of the Amateur Radio Service in **Part 97**, to see this:

(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communications service, particularly with respect to providing emergency communications.

A newcomer tuning around on the amateur bands, however, probably senses anything but *bien public* there. He hears **pile-ups** dotting the 15- and 20-meter **bands**. While tuning around the 40- or 80-meter bands, he runs across hams chatting amiably about the weather, new equipment, equipment modifications, and other similarly low-key topics. He also finds this **rag-chewing** on the 2-meter, 220-MHz, and 440-MHz bands. He soon discovers **nets** where members meet to pursue common interests—such as trading information about equipment from a particular manufacturer, playing chess, or reminiscing about common war-time experiences. (I once came across a grandfather clock net where the members recognized each other by the sound of their clocks' chimes!)

He may conclude from all of this that amateur radio caters only its own interests and is unprepared for future emergencies—a service straying from its premier **FCC** mandate. How wrong he would be! The conditions outlined below show why amateur radio is the world's finest and most reliable emergency communications system.

Marriage of Self-Interest and Public Service

Many nets meet with the intent to rehearse emergency communications. The conduct of almost *all* nets, however, contributes to this end.

Traffic nets and **DX** nets are two of the most common kinds of ham nets. **CW** as well as **voice** nets are very popular. Members of traffic nets relay **radiograms**, which anyone[1], ham or no, may originate and receive. One ham relays a message to the next, until it reaches its destination. People who have played the "rumor" circle game as kids may recall how information tends to distort as it passes from person to person. Traffic nets have developed a strict procedure to minimize this distortion.

DX nets meet to provide hams an opportunity to contact other hams in rare countries. These nets need tight control to maximize the number of stations contacting the rare station. If the situation is left uncontrolled, the hapless rare station spends more time trying to get DXers to quiet down than actually contacting them!

The skills hams develop in these pursuits—message handling and net control—are vital to the smooth operation of emergency communications.

Resilient and Fair

Besides retaining the largest pool of skilled volunteers, the Amateur radio service provides the most enduring communications in regions ravaged by natural disasters for these reasons:

- System portability and compactness
- Self-contained power supply
- Requirement of knowledge of CW
- Volunteer-*only* tenet of the Amateur Radio Service.

There are **transceivers** available now that, weighing less than ten pounds, powered for a number of hours from a car battery, and requiring only a **dipole** antenna a few dozen feet above the ground, afford *reliable* long-distance communications. Such self-contained systems let amateur communications remain intact when a natural disaster such as a hurricane or earthquake strikes an area and knocks out telephone lines and public service electricity.

CW and voice are the two most common communication modes. CW—this much-maligned mode—is the more reliable of the two during poor conditions. This is because CW conveys information using only three distinct elements—the "dit" (short tone), the "dah" (long tone), and the "space" (no tone)—which stand out in greater contrast to the ambient noise than do the many **amplitudes** and **frequencies** that voice uses to compose intelligence. Since most countries still require aspirants to learn CW to get any sort of amateur license, amateur radio service world-wide retains the largest pool of CW operators of *any* communication service.

One must not discount the non-remunerative nature of ham radio. Those who do have forgotten their horror at the callousness of nurses striking solely for pay, or that of a hospital that refuses to treat seriously ill patients who can't pay for their treatment! *Amateur radio's non-pecuniary nature deters preferential treatment.*

This policy, however, has not deterred hams' willingness to assist in emergencies. There are innumerable accounts—the most recent are the vital role hams played in emergency communications during the 1976 Guatemalan earthquake, and, documented in this issue, the Salvadoran earthquake of October 1986. A few of the many situations are doctors thousands of miles away talking their inexperienced colleagues through an operation; summoning medical supplies; locating foundering ships at sea; finding lost campers; and directing rescue operations for people caught in floods, blizzards, earthquakes, hurricanes, and tornadoes. Jerrold Swank W8HXR in his book *The Magic of Ham Radio* lists 65 pages of the most spectacular rescue operations our service has assisted.[2]

The Amateur Radio Service is a great latent strength. You hopefully will never need proof of this, but rest assured we're there for you!

...de KA1HY/AE

1 - *If the message passes only between countries with third-party agreements.*

2 - *The Magic of Ham Radio is sold in Uncle Wayne's Bookshelf, found on page 95 of this issue.*

GLOSSARY

Amplitude-The strength of a signal. CW uses only maximum strength or no strength. The amplitude of a voice-modulated signal constantly varies.
Band - A segment of the radio-frequency spectrum.
CW - Synonymous with Morse code.
Dipole - A simple and effective antenna popular with hams due to its easy and fast assembly.
DX - "Long-distance."
FCC - Acronym for "Federal Communications Commission." This is the US government agency responsible for the allocation of frequencies for radiocommunications and broadcasting in the US.
Frequency - As a radio wave travels through space, its amplitude varies with wave-like peaks and troughs. The frequency of a wave, denoted in Hertz (Hz), is the number of peaks that pass a fixed point in space in one second.
Part 97 - The section of the FCC Rules and Regulations that deal specifically with the Amateur Radio Service.
Pile-up - A collection of many stations tuned to the same frequency. Simultaneous transmissions cause confusion due to mutual interference. This often occurs when many hams try to contact a rare station.
Radiogram - A telegram which the Amateur Radio Service (ARS) is authorized to send, free of charge.
Rag-chew - Casually discuss.
Transceiver - A radio station capable of both receiving and transmitting.
Voice - Mode in which the human voice modulates a radio wave.

STAFF

PUBLISHER
Wayne Green W2NSD/1
ASSOCIATE PUBLISHER
Stuart Norwood

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SENIOR EDITOR
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Dan Croteau

Editorial Offices
WGE Center
Peterborough, NH 03458-1194
603-525-4201

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73 AMATEUR RADIO

APRIL 1988 Issue # 331

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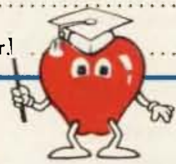

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FEEDBACK . . . FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 97. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to 73.

Cover design by Robert Dukette
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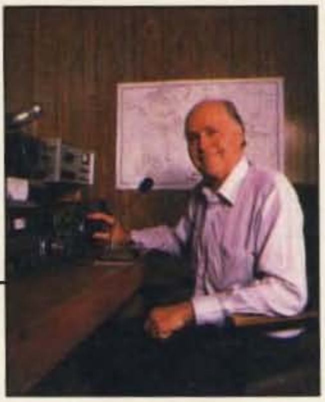
Number 2 on your Feedback card

NEVER SAY DIE



1988 Electronic Show Tours

Commerce Tours has three trips coming up this year that may interest you. One will get you to Sao Paulo for the Tropictronics trade show, and then to Buenos Aires for Electronica 88, May 22–June 3. It also stops at Rio for a couple of days. The tour is great for sightseeing and for checking out import/export potentials, in case you need a business purpose for the trip. The B.A. show has over 250 exhibitors from all over South America, and it's probably the best opportunity you'll ever have to meet with small businessmen.

The tour, including first-class hotels, airfare, breakfasts, some lunches, dinners and receptions, factory visits, business meetings, sightseeing, etc., is $2,850 from Miami (a bit more from other major cities). Let me know if you'd like a detailed brochure and prices. Write Wayne Green, S.A. Tour, WGE Center, Peterborough, NH 03458.

The annual Asian Consumer Electronic Show tour will be October 8–22, going to Hong Kong, Taipei, Seoul, and Tokyo. I've been going on this tour for over ten years, and it's first rate. There's always a bunch of hams. It's great for sightseeing, for import/export business, or just for keeping track of Asian electronics progress.

For anyone interested in developing business with China, there's a special China electronics tour November 2–12 to Beijing, Nanjing, and Shanghai. If you're interested in any of these tours, call or drop me a line and I'll get the details to you. Business with China is picking up fast these days and offering many opportunities. You may want to get inside reports on this via China EDP, a superb computer/electronics newsletter, for $395 a year. It's published by a good Chinese friend of mine in Hong Kong.

Wayne's Travel

The Orlando hamfest happened the same weekend as a music convention in Los Angeles, put on by the National Association of Record Merchandisers (NARM), so I missed Orlando. As the editor/publisher of *Digital Audio and Compact Disc (DA)*, NARM is where I get to talk with the major record company executives. It's like the Dayton of the record industry.

In late May, we're planning on a short *73* DXpedition to St. Pierre FP8. You can bet I don't plan to miss that. In June there's the Dallas hamfest, which is usually a corker—think I'm speaking there again.

In September I'm planning a short visit to the Dusseldorf CES show to see what's doing in Europe. Then on to Switzerland for an IARU international fox-hunting contest. I hope to get fox-hunting revived here in America, so I thought you'd be interested in this event. Right after this, I'll be back to give a talk at the Peoria hamfest—if you're in the area.

Dayton in Perspective

Dayton's doing well. About 30,000 attended in 1987, though I think I heard some mumbling about a bunch of counterfeit tickets, so the actual attendance may be in doubt. Cramming 193 commercial exhibitors into a small space made it difficult to get around.

It isn't much better in the flea market, with around 1,500 exhibitors there. If only $1,000 each changes hands, that's $1.5 million in sales in the flea market. No wonder they're queued up for hours before set-up time.

The commercial exhibitors come armed with truckloads of ham gear, ready to be beat down to pennies of profit, or even a slight loss, so they won't have to cart it all back to the store. I remember when Drake used to trade in on this pattern—letting dealer back orders pile up, and then dumping huge loads of their equipment on their dealers at the Hamvention, thus assuring that no one made anything much except Drake. It sure moved a lol of Drake gear into midwestern hamshacks at rock bottom prices, and it helped put many dealers out of business.

QSL OF THE MONTH

To enter your OSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRM

Editorial Offices
WGE Center
Peterborough NH 03458-1194
phone: 603-525-4201

Advertising Offices
WGE Center
Peterborough NH 03458-1194
phone: 800-225-5083

Circulation Offices
WGE Center
Peterborough NH 03458-1194
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Contract: Too bad—merely reading this is a binding contract between you and the publisher. To get more pages for *73*, more advertising is necessary. To get more advertising, more readers are needed. You hereby agree to be an official *73* subscription agent. You will tell every ham you contact that you read about him in *73* this month so he'll rush out to buy a copy. It's just a little Green lie, so stop sweating. It'll work. He'll frantically read every word in the magazine, discovering its magnificence in the process. Look, if reason doesn't work we'll have to use subterfuge.

QRX . . .

EDITED BY BRYAN HASTINGS KA1HY

150 Years of CW

The 150th anniversary of the first demonstration of the telegraph will occur in 1988. Special events are planned at several sites including Speedwell—the restored historic village in Morristown, New Jersey. In 1838, Samuel F.B. Morse and his assistant Alfred Vail first publicly demonstrated the electromagnetic telegraph in Morristown. After multiple careers as an inventor, painter, minister, and New York City mayoral candidate, and failed experiments with the telegraph, Morse successfully transmitted, "A patient waiter is no loser," at Vail's home in Morristown, New Jersey. Today, the site's buildings contain working models of the telegraph with demonstrations and lectures provided. From February 1–March 20, the newly established Sci-Tech Center will show its first Morse related exhibit titled "A World of Wire and Light" and in April, an International Telegraphers hook-up will be staged from either the Speedwell site or the nearby Victoria Station restaurant in Whippany, New Jersey.

Scholar Dollars

The Dayton Amateur Radio Association is now accepting applications for its 1988 Scholorship Program. The program is open to any licensed amateur graduating from high school in 1988. Awards will be based on a combination of financial need and academic accomplishment with consideration given for service to amateur radio and community involvement. There are no restrictions on a students course of study, and applicants are not restricted to those preparing to pursue four year baccalaureate degrees. DARA will also consider ham applicants working toward Associate Degrees or planning to attend an accredited technical institution. Each winner will receive $1,000 toward their tuition at a school of their choice. All entries must be postmarked no later then May 15 with winners announced on or about June 1. For information and application forms write to the Scholarship Committee, Dayton Amateur Radio Association, 317 Ernest Avenue, Dayton OH 45405.

More $$ For Ham Scholars

The Foundation for Amateur Radio, Inc, a non-profit organization headquartered in Washington, D.C. plans to award 28 scholarships for the academic year 1988–89 to assist licensed radio amateurs. The foundation, composed of fifty local area Amateur Radio clubs, fully funds six of these scholarships with the income from grants, and its annual hamfest. It administers the remaining scholarships, without cost to the donors. These donors include the QCWA, 10-10 International, and ARCs nation-wide, many in the DC area.

Some of the scholarships require that the applicant hold at least a General-class license. The awards range from $500–$2000, and preference is in some cases given to residents of specified geographic areas, and to students pursuing certain study programs.

For additional info and application forms, send a letter or QSL card postmarked before May 31, 1988, to FAR Scholarships, 6903 Rhode Island Avenue, College Park, MD 20740.

TAPR

In a surprise announcement, Lyie Johnson WA7GXD resigned as President of TAPR, the Tucson Area Packet Radio group. He cited intense professional and family pressures as reasons for his resignation. No one, even those who worked with Lyle on a day-to-day basis, anticipated this move.

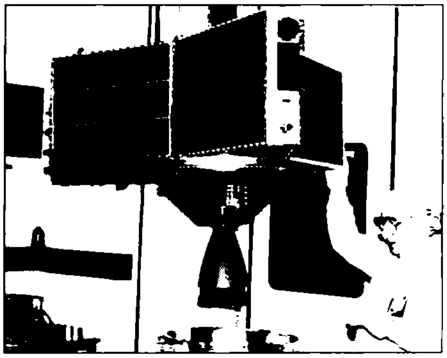
Johnson is instrumental in packet radio development.

6m in PA-land

Effective 1 March 1988, radio amateurs in the Netherlands will be permitted to operate up to 30 watts out on CW on the 50–50.45 MHz portion of the 6m band. Previously, the 6m band was off limits to amateurs in this country.

New 610 Forms

As of 1 Jan, 1988 the FCC made available the new version of the FCC Form 610 application for an Amateur Radio station and/or operator license. The revised form is useful for both FCC Volunteer Examination programs. The new form has the administering VE's report providing for the split of Element 3 into 3A for Technician and 3B for General class tests. The reverse side of the 610 provides for two Novice VEs. The forms are available from FCC, Attn: Larry Weikert, Chief-General Radio Branch, PO Box 1020, Gettysburg PA 17326 or at (717) 337-1212.



AMSAT's Phase 3C satellite is carefully lowered onto a shake table for vibration tests. Launch of this satellite is slated for late spring. (W4PUJ photo)

ERP Radar

The Canadian DOC finally decided in favor of erecting a 1-MW ERP Doppler-shift radar site near Egbert, Ont. The radar station may not be in operation for nearly two years, however, because of high construction costs. It's now believed, too, that its potential for causing interference to the amateur 70cm band is not nearly as bad as first thought.

McNamara

Robert H. McNamara has been named the permanent successor to Raymond A. Kowalski as the FCC's Chief of the Special Services Division. For the past few years, McNamara served as Chief of the Aviation and Marine Branch under Kowalski. Roger Madden, who has been acting Division Chief, is reportedly returning to his Deputy Chief's position.

73 BBS Back Up!

In an effort to further connect with our readership, *73 Magazine* brought the Bulletin Board System back up after a year-and-a-half interlude. Our readership once again has another medium by which to express their ideas and comments, and, of course, submit manuscripts. It is a 24-hour/day service, and a "sysop" (system operator) will be attending the system for an hour each weekday. Call us at (603) 525-4438!

And . . .

Meet the *73* Editorial people on the air! Larry NA5E is on the air on Tuesdays and Thursdays at 1830 UTC on 14.173 MHz. Bryan KA1HY is on at 1700 UTC most weekdays on 14.200 MHz, and at 2000 UTC on the same frequency on Sundays. Wayne W2NSD/1 keeps an irregular schedule, but listen on 20 meters SSB Saturdays from 1200 UTC.

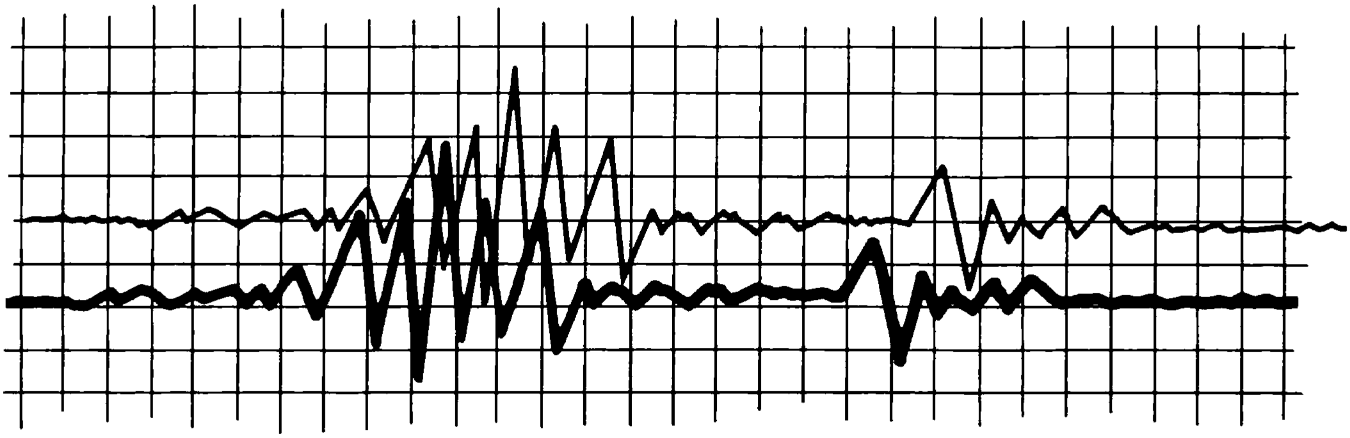
Hats Off to

Westlink, W5YI Report, CRRL Newsletter, and AMSAT, for their news contributions this month. We welcome any and all news items of interest to hams. Don't forget black and white or color photos! Please send them to *73 Magazine*, 70 Rt. 202N, Peterborough, NH 03458. Attn: QRX.

Ham Radio at Its Best

Emergency! Turn to 14.275 MHz—the International Amateur Radio Network.

by Jim Sammons KA1PZV



It is a morning like many mornings in October. A slight chill is in the air. Breezes rustle the colorful leaves. Time to get the blood going with a cup of coffee! The power is already turned on in the ham shack. The Collins KWM-380 is alive with signals from faraway lands. The scene is Belgrade Lakes, Maine, station K1MAN, outpost for the International Amateur Radio Network. Day in and day out, seven days a week, fifty-two weeks a year, Glenn Baxter makes himself available to help people when they need it most.

The Earthquake

This morning will be different from most. The date is October 1, 1987. The time is 10:58 AM. The phone rings and CBS News in New York calls to inquire if the International Amateur Radio Network (IARN) has any information concerning the earthquake that ripped through the Los Angeles area just 12 minutes ago. CBS is asked if they have called the Earthquake Center in Colorado. CBS replies, "Yes, but we were put on hold."

The IARN immediately activates with a call put out for information to or from the LA area. Instantly, Dale Martin KF6NQ answers the call to confirm reports of a 6-6.1 Richter Scale reading in the area south of LA.

A quick telephone call to assistant net manager KA1PZV, and the telephone computer bulletin board system is ready to handle emergency traffic. The 10-meter net activates on 28.475 MHz to handle local traffic, and David Speltz KB1PJ turns on the computer BBS system for Central US operations in Shaker Heights, Ohio.

Within a few short minutes, information begins to reach net control. Reports from the area tell of destruction, fires, several deaths, and aftershocks. CBS News shares their information with IARN for the next ninety minutes.

Amateur radio is about to perform as intended. The frequency is now alive with radio operators from around the country, some making queries, some asking if they can be of assistance.

> *"Within a few short minutes, information begins to reach net control."*

With past experience in emergency communications, a well-tuned and oiled emergency communications network is ready to handle the traffic. Preparations for such a situation have been in place for quite a while at the IARN. Tests are made regularly to look for flaws in the system. This time it is not a drill.

Net Control K1MAN takes command. He's been through this many times—his calm control is conveyed over the air and brings about a smooth and orderly process of taking traffic, assigning coded numbers for reply, and transmitting the traffic to California for query. Hundreds of signals from England, Germany, South America, and every corner of the US come in nearly simultaneously. All receive a caring and orderly response until each and every one has been acknowledged. Contact with IARN directors in the UK and Germany has brought about world-wide mobilization of emergency radio communications.

Meanwhile, support operators pass traffic to net control using every means available. Charlie Mills KC1FK passes traffic to the 20-meter net gathered from the 10-meter net. KF5TC reports that he is standing by on 14.090 MHz to respond to RTTY communications.

In what seems a very short time, the replies are coming in from California: Mexico 1 is ok, Mexico 2 is ok, and so on. Radio operators get replies to their queries, and many thank the net for the help. The emergency could have been much worse, and IARN would have responded in the same professional manner.

The Key

This is what IARN is all about: Helping without regard to politics or race or any of the issues that are irrelevant to the emergency. These are the people who can respond when the chips are down.

Literally thousands know where to turn—what frequency will get the message through—14.275 MHz, the International Amateur Radio Network.

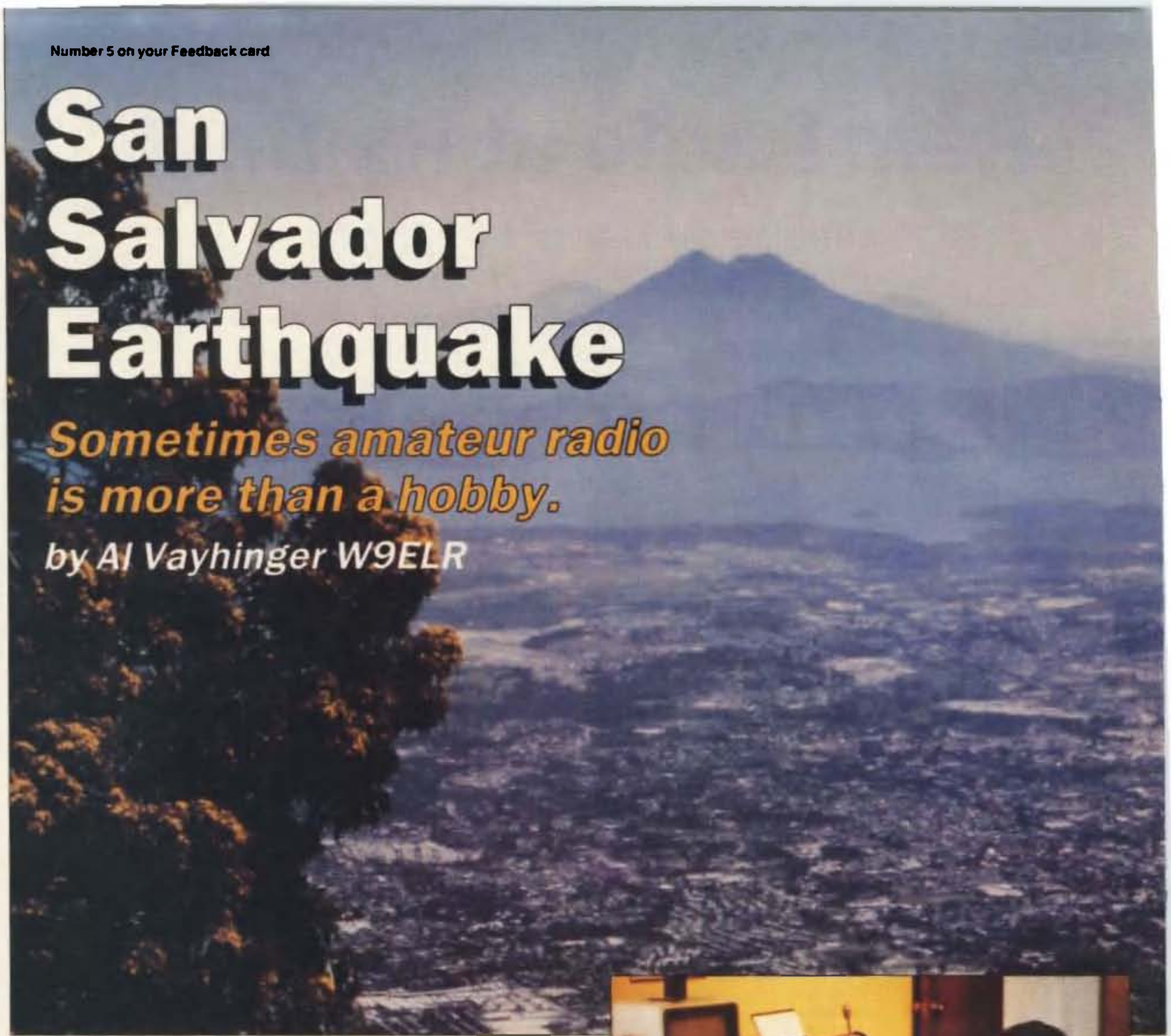
It is an evening much like any other in October. There is a chill in the air and a breeze rustles the leaves. Time for a cup of coffee...

Jim Sammons KA1PZV lives on Jodie Lane in Fairfield Center, ME 04937. He is a former medical research technologist and serves the IARN as Director of Computer Operations.

San Salvador Earthquake

Sometimes amateur radio is more than a hobby.

by Al Vayhinger W9ELR



On October 10, 1986, a major earthquake ravaged El Salvador, inflicting considerable damage to its capital, San Salvador. Many countries immediately mobilized aid for the tiny Central American country, but weeks later El Salvador still had many needs to satisfy. While tuning across the 20-meter band in early November, I came across Glenn Baxter K1MAN of the International Amateur Radio Network. During his conversation with a Salvadoran ham, the country's continued troubles became all too clear.

Instant Volunteer

All of the telephone lines were out of order in San Salvador. They needed a volunteer ham in the country to pass emergency traffic and coordinate the activities of volunteer medical personnel already in El Salvador. I knew very little about the country, but I immediately offered to help, and Mario Tona YS1TG came on the frequency and agreed to be my host in El Salvador.

Arrival

The following Friday, with just a suitcase and a pair of two-meter transceivers, this new recruit arrived in San Salvador. Mario further offered his HF radio for traffic handling and coordination.

Richard Horner KZ1P and Chester Stemp YS9CHE met me at the airport. Richard was also a volunteer from the States and had been there about two weeks operating and repairing radio and medical equipment. Chester, an American who lives in San Salvador, speaks Spanish fluently.

Getting Down to Business

No time to waste. Shortly after my arrival, we began making plans for a team of nine volunteer medical doctors, headed by Dr. F.H. Young K4SFE, to arrive from Columbia, South Carolina. We made daily contact with either Walt Ockoskis K4VMG or Bill Weathersbee WB4UGV in Columbia to arrange to get the medical team into the country.

While waiting for the team to arrive from South Carolina, we handled all of the radio traffic for a makeshift field hospital set up by the Salvation Army. The IARN had sent two volunteer American doctors to work in this hospital. There were several phone patches to

the States for medical supplies urgently needed for the hospital. In the meantime, a small girl caught her hair in a sugar cane mill and needed urgent medical attention in the States. The IARN arranged her trip there. Later this important network also helped arrange a trip to the US for a Salvadoran infant with a congenital heart defect.

When the Salvadoreans needed assistance, amateur radio often provided an essential link to aid.

After we made several trips to the airport to expedite the arrival of medical supplies, the team from South Carolina finally arrived. They brought with them over 1½ tons of medical supplies, donated to the relief effort. These supplies were all taken to Chester's home for inventory and to decide where they were most needed. Even 3000 pounds of medical supplies sometimes fell short. Volunteer doctors and members of the local ham club took money out of their own pockets to purchase badly needed drugs when emergency situations arose.

Phone Home

Ham radio also provided essential links between stressed and overworked volunteers and their families in the US. Phone patches with loved ones meant a great deal to everyone involved.

Thanksgiving Day proved especially uplifting for the American volunteer medical team. The Governor of South Carolina talked by phone patch directly to the members of the medical team. Amateur radio's utility certainly received a boost then.

On my wife's birthday, I talked to Gordon Carlson N9GDV, who agreed to have flowers delivered for my wife. Gordon did everything right. However, my wife happened to be listening on 14.275 MHz, and that spoiled the whole surprise!

I spent 30 days in San Salvador. After seeing the volunteer doctors treating children whose parents had literally no money to pay, I was proud to be a small part of amateur radio and able to do something to help.

If you've thought twice about volunteering, think a third time. As the Salvadoreans say, "Una Experiencia Inolvidable!"

Thanks...

...to the members of the San Salvador Amateur Radio Club for their tremendous assistance. Special thanks to Mario and Chester, Maggie Garcia de Call YS1ZA, Magda YS9MBB, Francisco Rosales YS1AZ, and Francisco Rodriguez YS1FB. Many more local amateurs went out of their way to assist in the emergency and make us feel welcome. 73

Al W9ELR worked for 20 years for the Indiana State Police as a communications officer, before going on to Thailand to work for the State Department as a radiocommunications advisor. He's been a ham SWLer since 1943, and obtained his call and transmitting license in 1946. His address is R. R. #3, Box 149, Connersville, IN 47331.

Illustrations by Neil and Ian Dukette

The Bears Project

A Promising Educational Program

by Peter W. Kemp KZ1Z

The Bethel Educational Amateur Radio Society (BEARS) Project provides a series of practical amateur radio activities to use in the classroom to supplement and enhance traditional methods of instruction. The Technical Education Department of the Bethel Middle School in Connecticut introduced the program into their curriculum several years ago. The new Electronic Communications curriculum better acquaints the student with the basic fundamentals, theories and practical applications of electricity and electronics. The students learn various electronics specialities through a program of hands-on experiences and related research. At the end of this program, the students also qualify to take the Novice Class amateur radio examination.

The varied teaching methods used in the course provide students many opportunities to reinforce the information presented in lectures, media presentations and class demonstrations. The students gain hands-on experience through group and individual experiments, field trips, peer teaching, and independent research.

Electronic Communications is designed to span ten weeks. Classes run five days a week, for 45 minutes each period. It is geared for the eighth grade. By modifying the depth of the knowledge presented, however, a teaching group can readily apply this course to other grade levels. In addition to the regular course of study, there's a wide variety of co-curricular activities. Students participate in the co-curricular activites before and after school, and in the evening or weekends. Besides hamming, other activities include antenna erection parties; car pools to attend area electronic shows; local amateur radio club meetings; and tutorial programs, both as instructors and learners.

Student Activities

Specifically, students learn how to construct, assemble and operate an amateur radio station. They also learn a variety of communication techniques including Morse code, amplitude modulation, frequency modulation, single sideband (SSB), television (fast and slow scan modes), satellite modes, text (Baudot, ASCII, AMTOR, Packet VHF/HF), FAX, computers, telemetry and microwave techniques.

Students who refine their skills in any specialized area are encouraged to become tutors to other students as part of the class' Peer Teaching Program. These students provide Morse code instruction and basic operating/technical skill practice to other students. In this sense, the electronic communications program is self-perpetuating. Further, the students research and explore various areas of communications through independent study units.

The practical aspects of operating play large roles in the students' education. They do not focus entirely on the technical aspects of communications. As the students communicate with other hams, they learn about world geography, cultures, industries and foreign languages. They listen to major news events as they happen. Such examples include the evacuation of U.S. students in Grenada and the earthquakes in Mexico City. They secure weather data directly from the National Weather Service and the U.S. Naval Eastern Oceanography Center.

Students relay information to other school departments. Weather data goes to the science department, foreign language text goes to the Spanish and French classes, and current news events are relayed to the social studies department.

Also, students listen to a host of other transmissions, including Space Shuttle communications. Several years ago students took part in an experimental communications project, attempting to communicate with the STS-9 Space Shuttle Columbia.

The students participate in Field Day every June. This activity, sponsored by the American Radio Relay League, involves radio operators from the United States and Canada, operating under simulated emergency conditions. The experience includes setting up a radio station, using portable antennas and non-commercial power, and operating for a 24-hour period. This real-life application is a true test of a student's operating skills, and serves to develop his or her potential for public service.

More recently, students activated special event station KZ200Z, celebrating the bicentennial of the U.S. Constitution.

Outstanding Response

All classes have had a capacity enrollment since the program's inception. The great popularity of the program permits extra noncredit classes after school on the local public access cable. The community and students learn how to use the television public access channel at the station.

Since the formation of this program, nearly 400 students have obtained their Federal Communications Commission (FCC) Novice class amateur radio licenses. Alumni from the middle school are encouraged to remain active in the program. These alumni have greatly encouraged newcomers to the field with tutorial assistance and provided transportation to activities away from the school.

Diverse Study Program

The success of the program hinges largely on its interdisciplinary nature. The topics included are:

Mathematics
formula application
measuring skills
calculator use
the metric system
graphs and charts
data interpretation

Science
frequency
meterology
basic electricity
radiowave propagation
technology development
NASA Space Program
The Scientific method

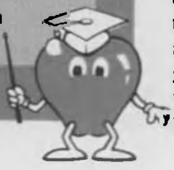
Music
frequency
sound reproduction

Graphic Arts
graphic reproduction
graphs and charts
cartography

Foreign Languages
French
Spanish
speech
culture

Social Studies
map and globe skills
map projections
international date line
time zones
geography
cultural and industrial development
current events

Language Arts
speech
note-taking skills
letter-writing skills
text translation



Students currently enrolled in the program arrive early to use the school's radio equipment and depart long after the school day has ended. Students and their parents have the opportunity to use the facilities during special Saturday morning and evening sessions.

The students often cite the Radio Field Day participation as one of the highlights of the program. The participants enjoy the planning and teamwork it takes to make it a successful event. Parents are also encouraged to assist in the overnight camping/communications activity.

Students frequently write about this program's activities in their language arts journals, as well as in local and school newspapers. The BEARS also publish a newsletter to encourage members to participation in ongoing programs in many levels.

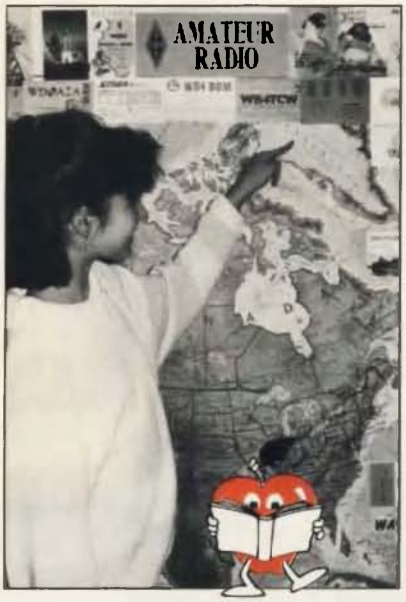


Photo A. A student finding the location of a recent contact–and developing geographical skills.

School and Community Response

The school and community overwhelmingly support the Electronic Communications program. The Parent Teacher Organization supported the program by allocating a portion of the proceeds from the school's annual magazine sale for amateur equipment for the school's radio station. State and local educational grants have provided additional funding. Amateur radio operators, businesses and estates of community residents have very generously donated to the Society, also.

The BEARS program supports the community in turn. Area newspapers often visit the facility during major news events to secure up-to-the-minute reports of domestic and foreign happenings. During the recent events in Grenada, the Bethel Middle School Amateur Radio Club relayed messages to the island for a family of a local resident attending St. George's University.

The school has recently assisted the local Office of Civil Preparedness in the development of a community communication plan.

Photo B. Jane Eager KA1FRQ snags a friendly contact.

Together they set up a complete emergency operations communications center. The center offers complete coverage of all government and amateur radio frequencies. It also has the first full-time Civil Preparedness Packet station in Connecticut, and a full-time Digipeater (KZ1Z-1, 145.07 MHz) serving the western part of the state. The middle school radio station is authorized to provide back-up communications for the Office of Civil Preparedness in the event of an emergency. The program received support from local amateur radio clubs, civic organizations, and community members.

The BEARS operate the first 220 MHz repeater in northern Fairfield County (KZ1Z/R 224.32 MHz), using it for technical training for the students and an ongoing public service to the community. Repeater users also handle National Traffic System messages.

In 1984 the school became a testing site for the FCC amateur radio examinations. The Electronic Communications program has also sponsored television programs on the local cable television channel and was featured in the recently released video, *The New World of Amateur Radio*.

Recent Developments

The BEARS Project has expanded into both the elementary and high school levels. Students from other schools regularly participate in BEARS activities. The high school plans to continue the middle school's electronic communications curriculum.

Further, the BEARS sponsor a short-term equipment loan program. The loan provides Novices with basic on-air equipment and accessories for operating from home stations or portable locations, such as the Boy Scout Jamboree On The Air events.

The students have also developed an independent learning center for elementary level students, complete with shortwave receivers and portable antennas. This has motivated younger students toward the major BEARS activities that go on at the middle school.

Photo D. BEARS participant Bob Murphy KA1FRE concentrates on code.

Photo C. Modern American Gothic? A fast-scan TV system held by Norbie Tarala N1EZI (left) and John MacDonald N1ERL.

It's Great!

The BEARS Program provides for the needs of students at all levels, elementary through adult. The program encourages participants to pursue the practical applications of technology both vocationally as well as avocationally. It stresses the interdiscipinary nature of amateur radio, thus enhancing all areas of the curriculum. The BEARS Program provides all participants with a sense of pride in accomplishment and, at the same time, *it's fun!* 73

Peter W. Kemp has received many outstanding awards for his achievements in education. He lectures professional educators on curriculum development and implementation of electronic communications programs for the Connecticut State Department of Education. He currently serves on two local government committees, the Cable Television Advisory Council and Emergency Telephone Communications (E-911) Study Group, and is the Coordinator of Technical Education at the Bethel Middle School.

Universal Power Supply Module

A regulator building block with countless applications.

by Rick Littlefield K1BQT

Need some power to make that project play? Here is a universal circuit that adapts to many applications!

All too often, power supplies are "crash efforts." Hams often hastily concoct them to get a project off the bench-supply and onto a dedicated source. However, the safety, reliability, and appearance of those supplies often reflect a slap-dash approach.

To get around this, I designed a "one-fits-all" regulator board to allow me to build supplies quickly, without placing valuable equipment, lives, and real estate at risk!

Circuit Description

This project takes advantage of the flexibility offered by U1, an LM-317 adjustable regulator (Figure 1). This device provides sophisticated short-circuit protection and automatic current limiting at 1.5A. Input voltage to the regulator is supplied by DB1, a 4A 100 PIV full-wave bridge rectifier. Capacitor C1 provides initial filtering. U1 provides additional electronic filtering as part of the regulating function. The output level of the regulator is set by trim-pot R1. Bypass capacitors on the input and output of U1 prevent high-frequency oscillation.

Transformer selection is important. When using a bridge-rectifier, the current rating of the transformer must be at least 1.8 times the rated continuous-duty output of the supply. This means that a 1.5A supply should use a 2.7A transformer. For light or intermittent loads, a smaller 2.0A transformer may suffice as long as it does not overheat or show an excessive voltage drop. Make sure the full-load output of the bridge is at least 3–4 volts above the desired output of the supply to insure that U1 will not drop out of regulation.

Parts should be easy to find. The circuit board was designed around off-the-shelf items available at most Radio Shack stores. Before starting construction, use the PC board as a template to mark mounting-hole locations on the power supply cabinet. Then, mount all parts as shown (Figure 2A). Note that U1 is located *underneath* the board, allowing it to use the cabinet as a heat-sink (Figure 2B). Be sure to connect transformer leads, the voltage output lead, and the LED output indicator lead before mounting the board in place. Use ¼" spacers to provide clearance for regulator. A ⅜" hole in the PC board provides access for U1 mounting hardware. Use heatsink compound and a TO-220 insulating kit to isolate the regulator mounting tab from ground.

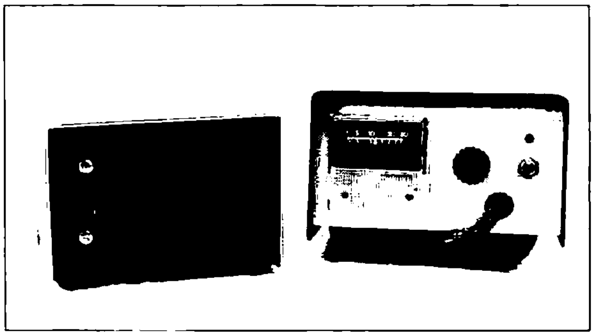


Photo A. This [illegible]able bench supply and 3A power-pack for a QRP rig are just two of many possible module applications.

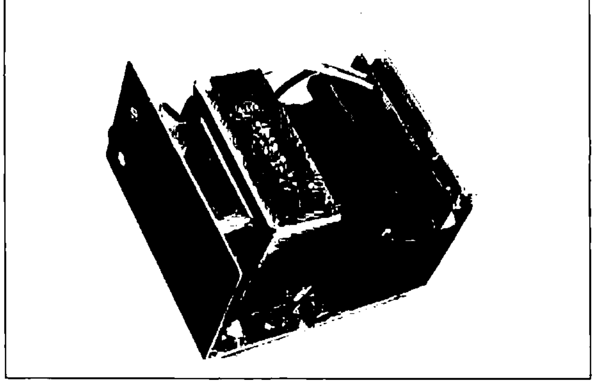


Photo B. Nearly all power supply parts mount on this 1 ⅝" x 2 ⅞" (4.2 x 7.3 cm) circuit board at left in box. Note that U1 fastens to the power supply cabinet which serves as a heatsink.

Applications

The regulator board can be used as is or modified to meet other needs. For example, a 5kΩ panel-mount pot wired in place of the PC trimmer creates an adjustable-voltage bench supply. The user needs only to add a simple voltmeter circuit to monitor output voltage. When the demand requires more than 1.5A, the basic module is modifiable in several ways to extend current-handling capacity (see Figure 3A).

- Add a 2200–4700µF capacitor at the output (C2) to stabilize output voltage when momentary peaks exceed 1.5A. C2's buffering action also improves U1's ability to track sudden load shifts, such as those encountered during CW or pulse eying. The 1N4002 diodes protect against the possibility of C2 discharging back through U1 and destroying it. Adding a 10µF electrolytic to the voltage-control terminal (C3) improves transient response further.

- Wiring a second LM-317 (U2) in parallel with U1 is a "quick-and-clean" way to increase the current-limiting threshold to 3A without sacrificing short-circuit protection.

- When more than 3A is required, the regulator module can be used to drive the base of one or more pass-transistors (see Figure 3B).

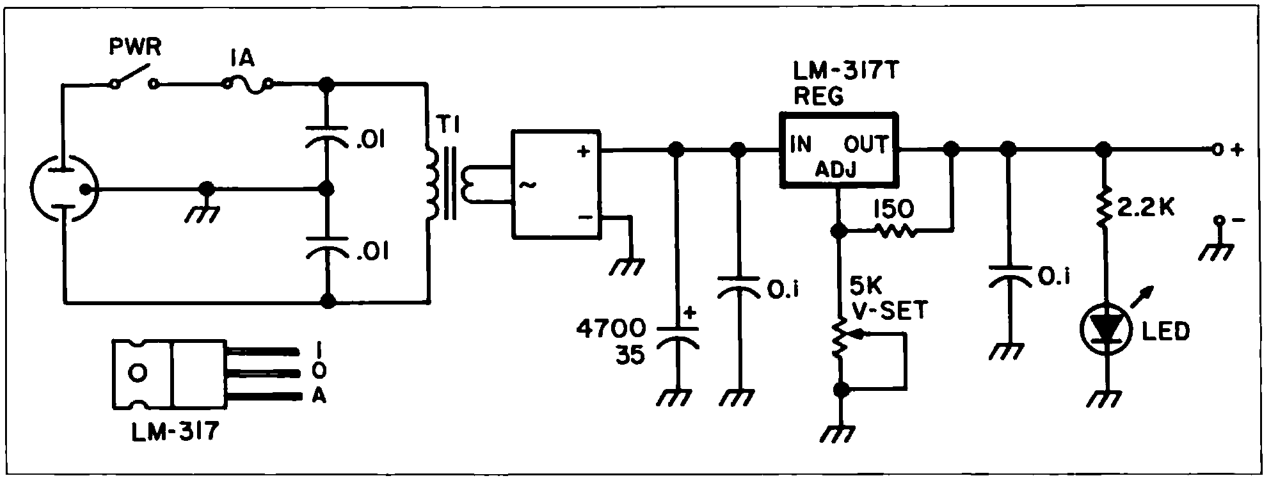


Figure 1. Circuit for the basic 3–30V, 1.5A adjustable power supply regulator.

Remember to follow basic safety practices when building *any* power supply. Use a three-wire or polarized line cord, and install a fuse or circuit-breaker in-line with the transformer primary. Switch the AC line, and bypass the primary against RF. Use shrink-tubing to cover exposed terminals carrying AC line voltage. Finally, make sure the DC supply is heavy enough to handle the current.

Voltage Regulator Module Parts List

1 — 4A, 100V PIV monolythic full-wave bridge (DB1)
1 — LM-317 adjustable regulator (U1)
1 — 4700µF, 35V electrolytic (C1)
1 — 2.2kΩ, ¼W
2 — .1µF ceramic, 50 volts
1 — 5kΩ, PC vertical-mount trim-pot
1 — 150Ω, ¼W
1 — Drilled and planted circuit board.

Conclusion

This module has reduced the task of designing and building supplies to a matter of selecting the right transformer, and finding a box to put it in. I generally build two or three regulator boards at a time, and keep the spares for later projects. Sooner or later, they always find a home! ■

References

DeMaw, "Some Power-Supply Design Basic," *QST*, January, 1987.

The ARRL Handbook, 1985.

Rick Littlefield K1BQT lives in Barrington NH with his wife and son. He is president of Omnicom Productions, a company dedicated to producing training videos for education and industry.

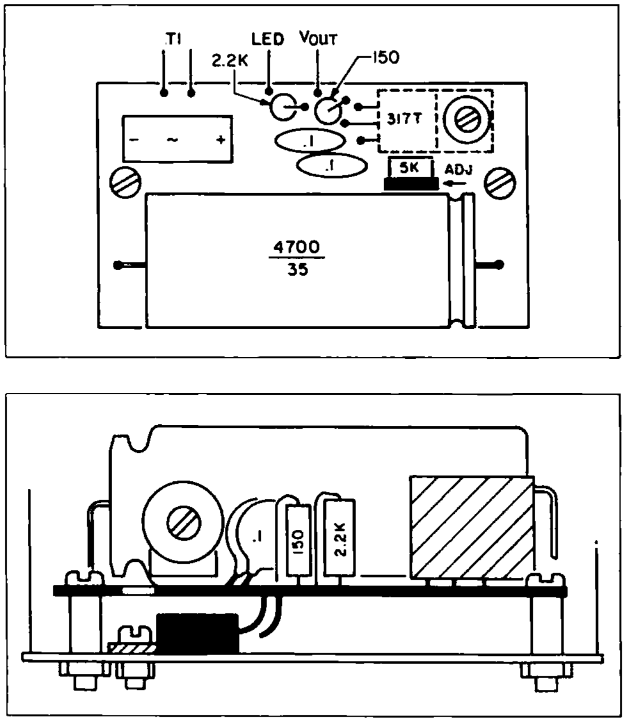


Figure 2A and 2B. Parts layout and mounting detail for the power supply regulator module. The circuit board is available from Radiokit.

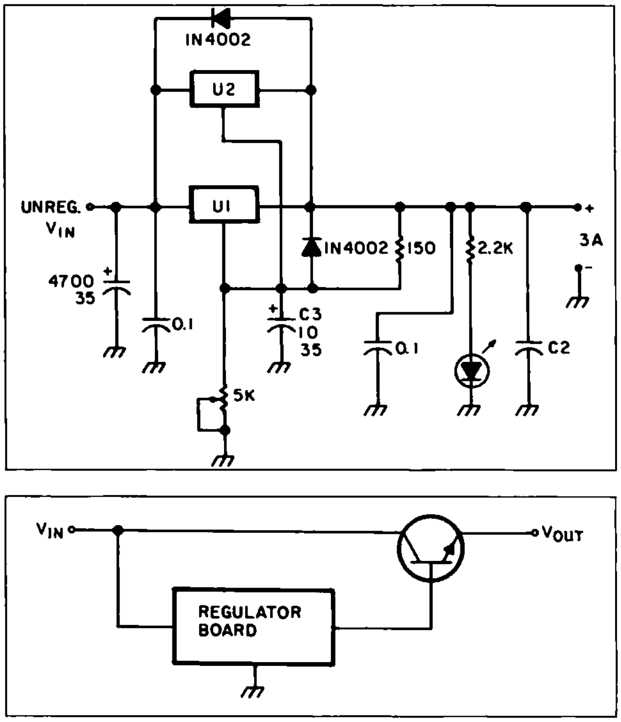


Figure 3A and 3B. Circuit modifications that increase transient response and current-handling capacity of the module.

Where are the Novices?

There's going to be a lot to talk about Novices this year at Dayton. It's now clear that the Novice Enhancement has been a total failure as far as attracting Novices to the hobby is concerned. The sad fact is that we're losing newcomers even faster than we lost 'em before, apparently due to the increased difficulty of the new Novice exams.

The number of newcomers to the hobby had been dropping about 10% a year. Now that rate has increased 50%, for a total loss of 15%.

Yes, I've read the rosy reports of mobs of new Novices. Now, it turns out, as we look more carefully at the 1987 FCC figures, all the ado and self-congratulations was over a two-month anomaly: Novices rushing to get their tickets before the new, stiffer rules went into effect.

Despite my call for ham clubs to make the licensing of Novices their #1 priority, the number of newcomers has dropped even further. Yes, a few clubs are making an effort, but most of the club newsletters I get are full of chit-chat, with little about Novice classes, and with not one mention of a club sponsoring a radio club in a neighborhood school. Not one.

Perhaps this year at Dayton it's time for me to discuss how we can best enjoy the few remaining years of our once wonderful hobby. Maybe it's time to stop trying to fight the tide, to go with the flow. Bad language, jamming, everyone for himself seems to be where we're going. Should we have awards for net jamming? How about articles on how to build repeater trashers—little hidden oscillators that randomly time repeaters out?

There goes Wayne, being rotten and sarcastic again. What'd you expect, Rodney Dangerfield? You want one-liners, try Neil Simon. So, do I have the half-baked notion that this whole mess lies on the conscience of what remains of our ham clubs? Pretty much, yep.

The scenario: more Novices = more hams = more engineers/technicians/scientists = more American electronics = more manufacturing of high value goods = regaining American financial leadership. Yes, that's simplified, but that's the basic way I see it—and I'm not going to expand it to a complete book right now.

You know as well as I do that electronics is the key to the next century. You also know that Japan is working diligently to be #1 in every aspect of electronics: communications, office equipment, entertainment, and finance.

At my Dayton talk, I'll try to have a place to put your walkers, an oxygen section for the emphysema sufferers, an ambulance standing by for stroke and heart attacks during my talk. I may have petitions for you to sign for a return to spark using the original and now largely forgotten Morse Code. Narrow band spark, naturally. Bring posters to wave. We're going to have ball!

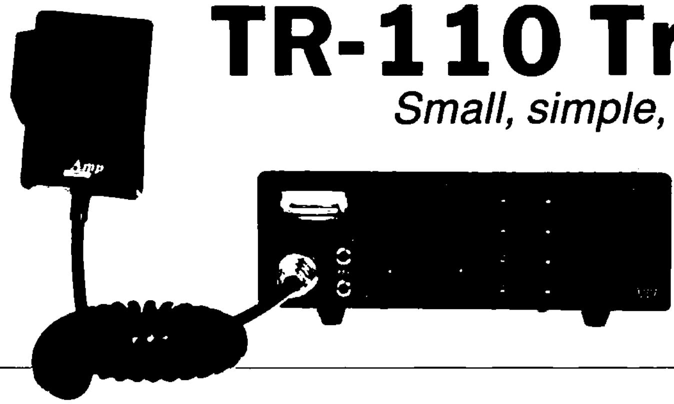
The Dayton officials tell me that my talk draws the largest crowd of the Hamvention. Well, outside of the banquet, anyway. Hmm, I think the last time I addressed the Hamvention banquet was around 1956.

73 Review

by Rick Littlefield K1BQT

TR-110 Transceiver

Small, simple, and reliable 10-meter rig.



Amp Supply Co.
6307 Chapel Hill Rd.
Raleigh NC 27607
Price Class: TR-110 Xcvr: $330
Mobile mounting bracket: $9.95
Noise blanker module: $24.50
250-Hz CW filter: $44.50

Ten-meter DX is improving rapidly, and Novice Enhancement has created a whole new wave of activity. Consequently, many folks are discovering (or re-discovering) how interesting and how much fun this band can be. The 10-meter monobander from Amp Supply couldn't come at a better time!

The TR-110 is actually one of a series of new rigs from Amp Supply Company, with other models covering 15, 20, 40, and 75/80 meters. Packaging is compact and lightweight, measuring 2⅜" high by 7" wide by 10" deep, and weighing just over 5 pounds. Tuning covers the entire band in both SSB and CW modes. Output is 20 watts, plenty of power to work the world without packing mega-pounds of DC supply. As 10 meters continues to open up, I suspect rigs like this will provide an exciting alternative to VHF-FM mobile operation for Novice and Extras alike.

Operation

The TR-110 comes in the traditional foam shipping box, complete with a mobile-type microphone, DC power cable, and spare fuse. The mobile mounting bracket is optional. To get on the air, all the buyer needs is a 5-amp 13.8 volt power source, and an antenna. A rapid-duped 12-page manual spells out installation and operation, and provides a block diagram of the transceiver's inner workings.

The front panel is attractive, conveniently laid out, and, best of all, simple. A large, easy-to-find VFO tuning knob is located on the right side of the panel. This drives a smooth opto-controller, which provides two tuning rates. Slow rotation yields a 5 kHz per turn rate in 100 Hz steps, while fast rotation boots the synthesizer into overdrive for large frequency excursions. Two smaller knobs control AF gain and RIT. One can easily identify these three controls by touch—a real plus for mobile operation. A vertical bank of four push-button switches select the band segment (10 meter version only), CW or SSB mode, optional noise blanker, and a dial-lock circuit.

The transceiver's four-digit frequency display uses easy-to-see .4" red LEDs and reads out to the nearest 100 Hz (the display doesn't indicate whether the 28 or 29 MHz band segment is selected from the push button control). The synthesizer sets itself to 000.0 on power up. As long as the power cable remains connected to an active power source, the radio may be turned on and off without disrupting the last frequency setting. A small green LED in the frequency display window indicates transmit status.

A conventional meter to the left of the frequency display indicates signal strength and power output. Mini-jacks are conveniently positioned next to the microphone jack for connecting a key and headphones. A sturdy 3" speaker is ported through the bottom of the cabinet, and a tilt-bail elevates the front to improve sound quality and provide a better view of the panel.

Looking under the hood, it was evident that the TR-110 is not a CB conversion or cut-rate rig. The circuitry is that of a radio designed specifically for ham use.

Performance

For initial testing, I set the transceiver on the bench and connected a dummy load. A quick check into a calibrated power meter revealed the transmitter was delivering the promised 20 watts in both modes. I then connect a Cushcraft R3 ½λ vertical and began tuning across the band. As luck would have it, a few strong South American signals came in. Right away, I contacted FG5BM and AY60F—and received good signal reports.

Next came a OSO with a local ham, familiar with my voice. He said the audio quality was good, and I sounded very natural. To compare his observation, I monitored myself on a second receiver and observed the waveform on a scope. To my ear, the audio quality was natural, though perhaps a bit too "mellow" to punch through heavy QRM and noise. Serious DX hunters may find some advantage in substituting a microphone with more bite. On the other hand, the scope pattern was clean.

Though I didn't measure sensitivity with a calibrated signal generator, on-air observations suggested a very hot front end. The design uses a low-noise MOSFET RF preamplifier, which may explain why the TR-110 easily outperformed a $1,000 all-band transceiver in side-by-side weak-signal comparisons. The AGC rate seemed to be a pleasant compromise for SSB and CW operation. Limiting was effective over a wide range of signals without pumping or cracking on voice peaks. Cranking up the AF gain revealed plenty of audio power, good for comfortable mobile operation. The one receiver feature local net operators may miss is a squelch.

CW Test

For the next test, I tuned down to the bottom of the band and plugged in a key. Again, working into South America was no problem. The TR-110 is surprisingly pleasant to operate on CW. It features semi-QSK operation and adjustable sidetone. The test unit didn't have the optional 250 Hz filter, but it's usually not necessary for casual CW operation on this band. (Twenty-meters is a different story). Checking the keying, I found the wavefront hard but free of clicks. Attack of the first character, the T/R switching cycle was audibly soft but not objectionable. On-air reports were good.

A couple of days later a friend Barry K1ZDS loaded the TR-110 into his diesel VW Rabbit for a mobile test ride. He too enjoyed the radio a great deal. During his travels around New England, Barry made several mobile contacts into the Southeastern United States and the Caribbean—including Cayman Island. In the diesel-powered vehicle, there wasn't any on-board ignition noise to contend with. Barry noted, however, that the optional noise blanker would be helpful in city traffic. His only real complaint was that the microphone cord was a bit short for his VW floor mount.

Conclusion

Overall, I found the Amp Supply TR-110 a very respectable little radio, and highly recommend it. The TR-series of monoband transceivers carry a standard factory warranty through a familiar and reputable import manufacturer (Tokyo Hi-Power Labs), and are manufactured for Amp Supply. ■

Rick K1BQT got his first ticket in 1957 at age 13, and is currently an Extra-class licensee. He publishes in many amateur radio publications including CQ Ham Radio (Japan). His forte is building QRP equipment. Those interested may reach Rick at Box 114, Barrington NH 03825.

In ham radio, as in many other endeavors, helping people in time of need is one of the most satisfying rewards. Of course for hams this requires skill, procedures, and equipment. While many great inventions have come "in the heat of battle" or while faced with a crisis of some sort, nothing heats advanced preparation.

Packet radio offers many advantages for disaster and emergency communications. It offers fast, error-free, transmission of data, names and addresses, in a form that can be viewed, studied, and even printed, and a modicum of security from the ubiquitous police scanner listeners. Thus, this tinkerer decided to put together an emergency/disaster packet station.

For the station, I wanted to be able to have either a user terminal or a digital repeater, called a "digipeater." It had to be small and light-weight—nearly pocketable—for easy portability. Of course, it had to be self-powered and affordable. It turns out this is not hard to do, if one accepts this equipment as a temporary, emergency expedient, and doesn't expect the convenience, reliability, and full features of a permanent set-up.

The Components

The radio for the station is the ICOM 02-AT. An assortment of rechargeable NiCd batteries can power this. Alternate supplies are two alkaline AA packs; a rechargeable Lithium pack; and 12 volts from a storage battery, that could be part of, for example, an automobile. It offers two output powers, ½ watt and 5 watts, and its "rubber ducky" is attached by a standard BNC connector, so it's easily replaced by a larger antenna.

There's another advantage to the 02-AT. While most packet activity is on 2 meters, there's also a lot on 220. This is either "backbone" stuff for the PBBSs or local activity in the Novice segment. The 02-AT sports a 220 twin sister, the 03-AT, that uses the same connectors and accessories. If a packeteer is set up with the 02-AT on 2m, he needs only to substitute a 03-AT to come up on 220.

The ICOM 2-AT, or the µ2-AT, are acceptable substitutes. Their main problems are a lower maximum output power and inability to run directly on 12 volts DC. Of course, "overshoes" in the form of one of the small, 12 volt, 1 watt to 10 watt amplifiers such as the Heath HA-201A can be added to either hand-held for a bit more umphf!

A fixed frequency handie-talkie might need a bit less stand-by power than a synthesized one and would lessen the possibility of changing frequency accidently, but for emergency work, a "rock-bound" rig is very limiting.

TNC

The best choice by far is the GLB PK1-L. At 25 mA, it uses about one tenth the current of the nearest competitor. A NEDA 1604 alkaline (the regular 9 volt "transistor" battery) will run the TNC for about 20 hours! The only problem that some may have with the PK1-L is a control code structure that is different from the TAPR and TAPR clones. I personally favor the GLB's commands. For example, if one gets a "busy signal" it's only a keystroke to reuse the same connect string. If a TAPR-compatible person uses the station, however, he'll need the cheat-sheet of instructions and still be exasperated.

The Computer

I use the NEC 8201A laptop, for no better reason than finding it on sale at a local computer store. It also runs on AA alkalines, which last for about a month of occasional use.

The major disadvantage to this type of computer is its 40-column-by-8-line liquid-crystal display. The screen is large and easy to read, but 320 characters is a pretty small window on a text file (most computer terminals offer 80 columns and 25 lines, or 2,000 characters, at a time). Also, the WØRLI PBBS software is based on 80 columns so, with 40 columns, PBBS entries don't line up under their headings and formatting is shot.

This won't be a big consideration for emergency work, however, unless a lot of arcane data is passing to or from a PBBS or other "unfriendly" computer facility. Of course, using an 80-column printer skirts this prob-

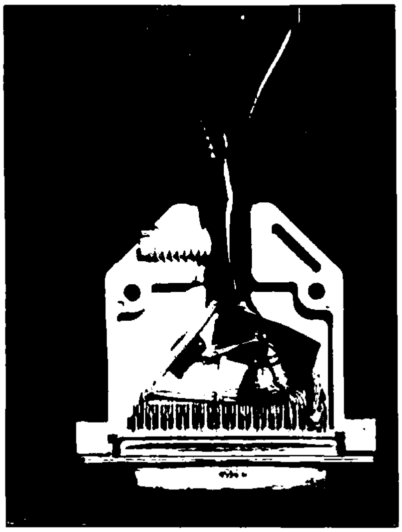


Photo A. TNC plug with components.

lem. (The 40-column limitation is only on the screen and does not affect hard-copy.) Using a printer, however, may not be practical in the field.

Slowness in displaying is another problem with the LCD. The NEC insists on displaying all incoming material. At high data speeds (such as 4800 or 9600 Baud) the display can't keep up. Run the computer-to-TNC link slower, (e.g. 1200 Baud) without using flow control. This translates to a TELCOM Status of 5171NN. (This will make sense to the operator when he gets into the documentation for the NEC's ROM-resident TELCOM program.)

The Radio Shack Models 100/102 are very similar to the NEC 8201A, and would also work well in this application. The Radio Shack and NEC models listed here, incidentally, are made by the same firm. Both come with ROM-resident terminal emulators including file up- and down-load capability. The inherent up- and down-load capability is important. It allows preparation of a message "off-line," where it can be reviewed and edited on the screen, then sent in a burst. It also allows storage of an incoming file for later study or reference. These computers are also capable of simultaneously printing an incoming file that it is storing (with a parallel printer hooked up).

These computers usually come with RAM (Random Access Memory) varying from

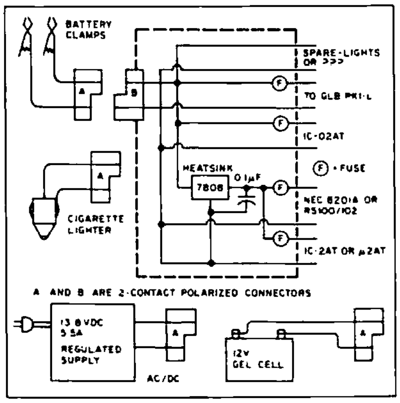


Figure 1. Power distribution box schematic.

"very little" to "not enough." Both NEC and Radio Shack, as well as several aftermarket firms, sell RAM expansion modules. I'm using the ones from Purple Computing. On the basic 8201A, two 8 KB modules fill out the first 32K bank and four more add a second 32K bank. That may not sound like a lot of storage these days, but at least the terminal program is in ROM, and so doesn't take up RAM space.

There are much more powerful (and expensive) portable and laptop computers that would work very nicely. These have 25 x 80 screens and much more storage capacity. I rejected them because of weight, fragility (if equipped with a disk drive), and most important, power consumption. The "large" machines have much bigger and heavier batteries, but most still get only 4 to 5 hours of operation on a charge.

There's one other possible accessory: a portable battery-operated printer. This moves the station set-up out of the "pocketable" category, and battery life (of four C cells) is limited, but it's certainly viable for those who need hard-copy capability. (See Photo I.)

Power

A good emergency packet station should be able to use any of three alternative power sources (and to swap from one to another), depending on the situation.

•Internal batteries. The complete set of disposables:

TNC - one 9-volt alkaline
Computer - four 1.5-volt AA alkalines

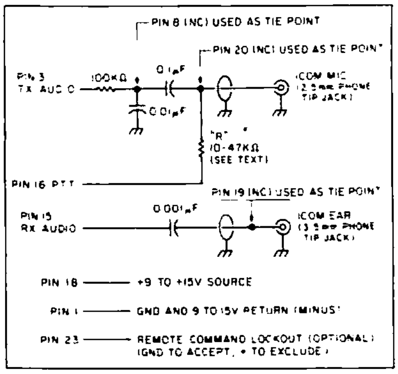


Figure 2. Radio-to-TNC cable schematic.

ICOM 02-AT - either six or ten 1.5-volt AA alkalines (This depends on the battery case. The 2-AT can't use the ten-cell case.)

•12-volt storage battery, or an automobile with one. The GLB and the 02-AT can be connected directly to 12 volts, but the NEC 8201A (or RS M-100) and the ICOM 2-AT, or µ2-AT (if used as a substitute) need no more than 8 volts. They require a 7808 solid-state series regulator. This calls down a little "spider box" distribution system to house the 7808, fuses, and the plugs for the various cables. (See Figure 1.)

•117-VAC house current. All of these devices can use individual AC power supplies, probably of the integral wall-plug transformer type. With the house current, however, there's less to carry and it's less confusing to use a single 3 or 4 ampere "CB-type" 13-volt regulated brick power supply to power the 12-volt distribution system.

•Gel cells. Two six-volt gel cells strapped together and kept on "float charge" serve as an excellent emergency power source. Several types of connectors hard-wired to the cells make the power pack extremely versatile.

CABLING Radio-to-TNC

Ideally, one would run the audio connections to the discriminator and to the modulator to avoid noise, and, particularly, to bypass the audio shaping that's meant to enhance voice communications. The problem is that going that route spells some radio modification. Radios couldn't be swapped

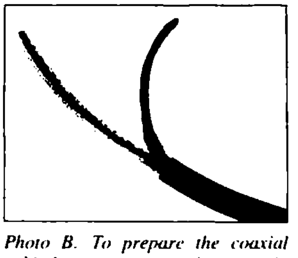


Photo B. To prepare the coaxial cable for connector attachment, strip the outer insulation and bulge the shield...

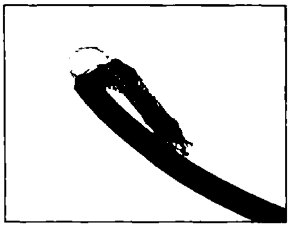


Photo C. . . . tease a diamond-shaped hole near the end of the insulation...

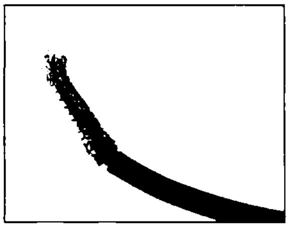


Photo D. . . . bend the coax and work tool through the hole and pull the center insulation loop clear...

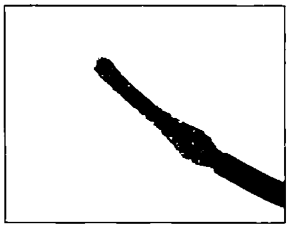


Photo E. . . . and massage the shield flat and tight.

quickly in the event of a failure. An operator has to accept a bit of signal degradation, work with the mike and speaker plugs, and at least partially compensate for the audio shaping with capacitors.

Both radio connections use RG-174-U. A 2.5mm plug is used on the mike line and a 3.5mm plug on the speaker line. There are nice cords made for use with computer cassette tape recorders, sometimes found in ham flea markets, that combine the mike and phone plugs. If it looks cheap, such as the mike cord for a cheap audio cassette recorder, watch out for poor or intermittent connections in the plug end. The TNC end of the cable is a DB-25S that needs some components within the shell to compensate for the audio shaping in the rig and to combine the transmit audio with the push-to-talk for the ICOM (Figure 2 and Photo 2).

A small note of explanation for "R" in the diagram. The ICOM uses a single line for both transmitted audio and for push-to-talk. If the value of "R" is too large, the radio won't detect the PTT closure. If it's too small, the audio level and the bias of the input transistor will be lowered, causing poor audio.

Connecting the ends of small coax is a bit tricky. First remove the outer insulation by cutting around the wire without nicking the shield. Then slide the shield back a small amount to loosen it (Photo B) and bend the stripped part of the coax sharply right next to the end of the outer insulation. With a jeweler's screwdriver (or similarly pointed tool), tease a diamond-shaped hole between bunches of the shield braid (Photo C). Work this hole large enough to pull the bent loop of insulated center conductor out through it (Photo D). Try to avoid cutting or breaking any strands of the braid. The braid can now be massaged down small and flat (Photo E).

In addition to providing the radio interface, this connector offers some interesting op-

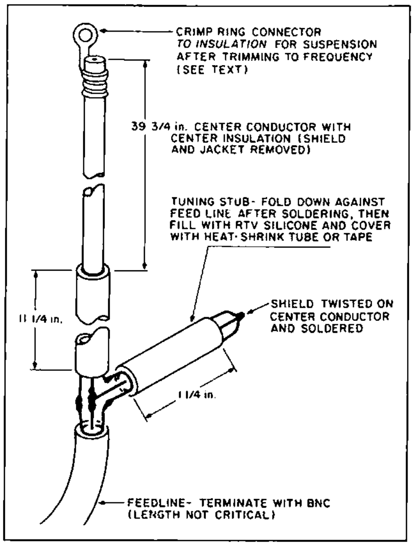


Figure 3. This half-wave antenna made from coaxial cable will provide much better performance than an HT's rubber duck.

tions. One is that, in unattended digipeater service, the PK1-L is capable of accepting remote commands to change operating parameters, beacon text, and even the digipeater call. Now, this is both a useful feature and a real opportunity for mischief. The commands to change these parameters aren't that hard to figure out.

Therefore, I suggest disabling the remote commands by tying Pin 23 of this connector high. They who are gluttons for punishment can mount a mini-sized slide switch in the side of the plug shell to switch Pin 23 between high and ground. It will suffice, however, to just hard-wire it in the position of choice.

This connector offers a RESET pin, but that's redundant with the internal reset switch, accessible through a hole in the side of the TNC case. There's also a "connected" signal, but it's too low-power to drive a buzzer or LED directly, even if the operator had battery power to spare. There are also some uncommitted inputs and outputs (in other applications, the uncommitted outputs could be used, for example, to switch frequencies, if remote commands are enabled), but I left these inputs and outputs unconnected for this use.

TNC Digi Jumper Plug

If the set-up is to be a pure digipeater (i.e., no communications at the digipeater site) the operator has to inform the TNC program of that fact by holding the RS-232 RxD (receive data) line high during power up or reset. To do this, he needs to wire a jumper between pins 2 and 5 of the DB-25P.

TNC–Computer Cable

This is the easiest cable—simply connect two DB-25Ps pin-to-pin. The most common way to make this is to use two insulation displacement connectors (IDCs) with 25-conductor ribbon cable (take one conductor from a 26 strip). Hand-wirers need only pins 1-7 and 20. I made my cable fairly long (5′ or so), in order to keep the connections between the radio and TNC short and still move the radio around for the best signal. Positioning flexibility is important when using the integral antenna, and because of the ability of the system to QRM itself with certain geometries.

Mark well the power cables for the radio, TNC, and computer for extended use, when 12-volt external power is available. The computer cable needs a 7808 voltage regulator to run from a 12-volt source. So does the radio, if it's the ICOM 2-AT or µ2-AT. An operator should be able to connect this cabling array to both an automobile cigarette lighter and to the posts of an automobile storage battery, with BIG battery clamps. *Clearly* mark positive and negative—one never knows who'll be hooking it up, and it might in the dark!

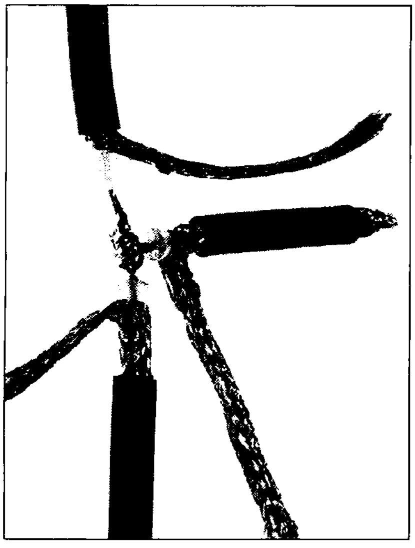


Photo F. Prepare the antenna pieces by stripping braid, twisting the end of the tuning stub, and soldering the center conductors together.

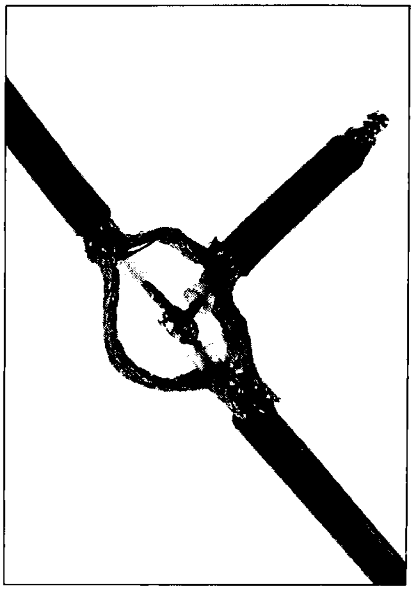


Photo G. Next connect the pieces' braid as shown.

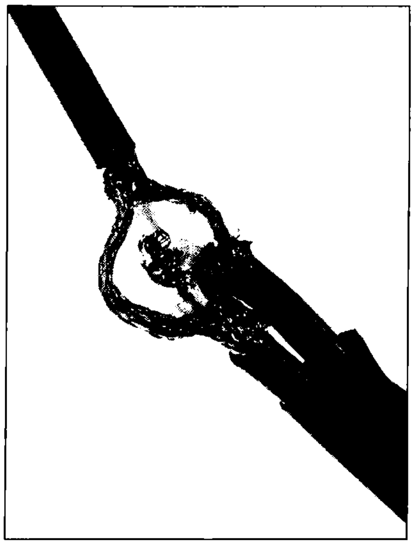


Photo H. Bending the stub down parallel to the feedline, secure with electrical tape, waterproof the joint with RTV, and cover with heat-shrink tubing.

Antennas

Of course the easiest and least effective antenna to use is the rubber duck that comes with the radio. However, because the ICOM 02-AT, 2-AT, and µ2-AT use a standard BNC antenna connector, alternatives abound. Always carry a quarter wave BNC-type pull-out rod antenna. Also, very important in any bag of goodies is a BNC-to-UHF adaptor (UG-255/U) that allows the use of an automobile roof-top ¼λ or ⅝λ whip, or even a structure-mounted 2-meter aerial. Here in southwestern New Hampshire, some hams have "pre-installed" permanent 2-meter antennas on several critical public buildings such as schools used as evacuation centers.

Easy-to-Make Vertical

Jack Knott of Aire Sciences suggests a great emergency ½λ vertical, economical to make and easy to carry and use. It's shown in Figure 3. It can be hauled up a (non-metallic) flagpole or pulled up between two trees using thrown (or sling-shotted) fishing line.

One can make Jack's antenna either from RG-58A/U or RG-174/U. The former offers lower losses, but is not quite as easy to make, store, and handle. (Bear in mind that antenna and feedline are one piece.) The length of the feedline will always be either too short or too long, but it's not critical. Mine's about 20'.

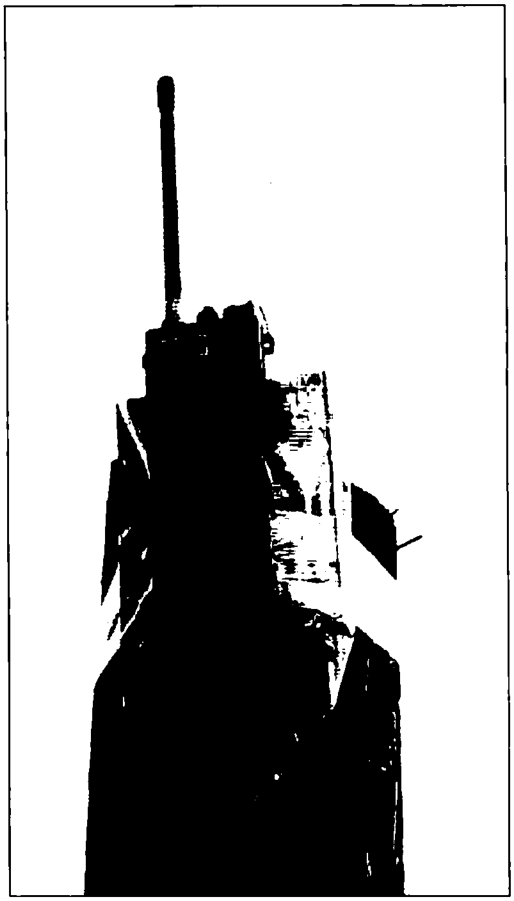


Photo I. A complete pole-top digipeater with HT and TNC protected with a plastic bag and secured with ducting tape.

To prepare the antenna, cut the outer insulation carefully 39-¾ inches from one end of the coax, then work it off the end of the cable with a series of pushes and pulls. Cut and remove the shield, being careful not to nick the insulation around the center conductor. Now, clip that piece of coax to length, and at the other end of the same piece, remove the outer insulation from the coax and separate the braid from the insulated center conductor tight to the outer insulation as shown earlier in the discription of the TNC-to-radio cable preparation.

Prepare both the feedline and the stub in the same way. To short circuit the opposite end of the tuning stub, cut the outer insulation to length, then force the center conductor with its insulation out through the braid by about ¼". Strip the ¼" of the center insulation off, then pull it back so that there is about ¼" of center conductor and shield braid at the end with no center insulator between. Check the length of the center insulation, then twist the braid down around the center conductor and solder.

Now the antenna can be assembled as shown in Figure 3 and Photos F-G. Make sure everything fits before soldering, and make doubly sure that the center conductors have not been nicked while stripping the inner insulators. The first time I made one of these antennas, I damaged one of the center conductors, which broke at the last moment. Of course only the feedline can be re-terminated without messing up the dimensions. When soldering, use a hot, heavy iron in order to get in and out fast without exposing the center insulator to any more heat than necessary.

The stub can now be folded down parallel to the feedline (Photo H), the spacing between the braids and the center conductors checked, and the whole joint filled with "RTV" (room-temperature vulcanizing) silicone rubber. Try to find and use a hydrogen-peroxide cure material, such as GE Silicone II window and door sealant, instead of the acetic acid kind. This reduces the chance of electrical leakage or corrosion. If the label doesn't specify, check for the vinegar smell of acetic acid.

When the RTV has set up, any rough spots on the outside of the joint can be smoothed with sandpaper or a file.

To "ice the cake," both the end of the coax shield and the stub connection and stub can be covered with the proper-sized heat-shrink tubing. The "official" tool for shrinking this tubing is pretty expensive, but one of the new electric paint-stripping guns does well if used *very* carefully. The paint-stripping gun is quite capable of melting the stub-joint solder under the tubing. Good electrical tape will suffice in the absence of the right-sized heat-shrink tubing.

In addition to increasing reliability, neat work at this point will be rewarded during thenext flood when the mayor points out you and your equipment to the governor, mentioning your invaluable public service.

The Final Step

Install a BNC connector on the opposite end of the feedline, and test the antenna using a VSWR bridge and the trusty 02-AT. Erect the antenna using heavy fishline or twine thrown over a tree branch or suspended from a piece of 2-by-4 or other nonconducting support, positioned vertically and as far as possible from the trunk or support. Measure and plot the VSWR every half MHz over the 2 meter ham band. It should show a null somewhere just below 144 MHz. If it does, clip about ¼" off the insulated center conductor at the top of the antenna, and remeasure and replot the VSWR.

Most 2 meter packet activity is around 145.01 through 145.09 MHz, so stop snipping when measurements show the null there. It's a good idea, however, to bring the null up a bit further in frequency, bearing in mind the possible need to operate voice. Most repeaters inputs are above 146 MHz. When the length is correct, crimp a ring connector onto the inner insulation (not the center conductor) in order to tie the suspension string to it.

For field erection, fasten either a regular fish sinker or a heavier-weight "sounder" to a piece of string, which is in turn tied to the end of the antenna. Throw the weight over a convenient tree. Many often use a sling-shot for some antennas, but for this application the extra bulk and weight may not be justified.

Accessories

Spare batteries. Any of these components can be run from NiCd batteries, but alkalines last two to three times as long and are more reliable in service.

A set of fresh batteries in the equipment at the start and a spare set in the pocket should see one through almost any disaster. Since both types are very common trade sizes, an operator can likely find them even in the field.

The operator should have pockets full of junk, a BNC-to-PL-259 adaptor, ¼λ and ⅝λ collapsible antennas, pocket beam, spare fuses, and coaxial extension cables with adaptor fittings. He should also have electrical tape, duct tape, clip leads, and waterproof plastic bags. One can make a "quicky-digi" by plastic-bagging the radio with a whip antenna and TNC and duct-taping the lot to the top of a telephone pole or other convenient mast. Of course, this lasts only as long as the radio batteries. One will also need an extension power cord with a fork at the end to allow both radio and TNC to run from a storage battery at the base of the pole.

One very handy tool to have is the Camillus Boy Scout knife!

Photo J. Margaret LePage N1FBC operates the emergency packet station just after a New Hampshire snow storm. It pays to be prepared.

Supplies

Paper, logging forms, pencils, and erasers! Also take along manuals and/or command "cheat sheets" for all the equipment that's commonly used in the area in question. Photocopy the essential instructions out of manuals. In many emergency situations, an operator may be relieved from his station by someone far less familiar with both packet and the equipment.

Get a list of all the available frequencies in the area. Get also a list of tone-codes and instructions for any computer-controlled voice repeaters in the area. Don't forget packet system maps, lists of Q-codes, and ARL numbered messages. Bear in mind that, in an emergency, one will likely be using unfamiliar procedures and facilities and may be called upon to provide information for others that the operator wouldn't himself may not need.

Take also state road maps, and copies of local area Coast & Geodetic Survey Quadrangles (topographic maps). A number of organizations (such as Civil Air Patrol and, in this area, the New Hampshire Forest Fire Service) have their own grid overlays for maps that allow them to specify map locations by alphanumeric groups. It's helpful to have keys for these locating schemes. Typical of government (or government-related) organizations, CAP is not generally aware of the Fire Service grid, nor is the Fire Service aware of CAP's!

Many newer VHF and UHF rigs (as well as the ubiquitous scanners) are able to monitor the adjacent public service bands, so it helps to have frequency lists for police, fire dispatch, utility and similar services, as well as other disaster helpers such as the Red Cross and CAP.

Of course, it's always wise to have a listing of phone numbers, both for area public services (civil defense, fire, police, hospital, utilities, etc.). Often one can also get (and should keep confidential) unlisted numbers for town/county/state disaster officials and coordinators.

If an emergency group has installed "just in case" antennas on any buildings that might be used during disasters, they should also have a listing of exactly where to find the radio end of the coax (it'll probably be hidden from the normal building occupants) and how to tell which is which if there's more than one.

This information constantly changes. Someone should be responsible for the periodic updating and distribution of the information in the "emergency book." The middle of an earthquake or a tornado is not a good time to try to deliver a year's worth of revision sheets!

All of this literature can go into a slim Accopress Binder that's kept in a plastic ziptop envelope along with some folded light plastic. Many disasters are accompanied by such inclemencies as wind and rain! Those really prepared will take along a flashlight, candles and matches. There's also a great "soft-case" First Aid kit that's available from any American Red Cross Chapter House for only $25.

Case for a Case

All of this material (with the obvious exception of an automobile storage battery) fits into an attache case found in many local discount stores. I've used one of these, and for many situations, it's very effective. I am also apt to respond to an emergency situation in a surplus military field jacket, the kind with BIG pockets! When called on in most emergencies, one can get some idea of the nature and duration of the service that's needed, and fill these pockets accordingly.

Finis

A lot of fine equipment for emergency use is wonderful, but it's not enough if an operator doesn't know how to operate it. Hams have the advantage here in that, in an emergency, they do something they normally do every day: communicate. To exploit qualifications and equipment properly, hams must plan and drill, even if only informally.

When the emergency packet station is set up as described here, try it out under varied, simulated emergency conditions. Pay particular attention to transmit and receive audio levels settings, which are covered in the manuals. Find out *before* the emergency that the plugs don't mate or the SSID of the big digi on a little-used frequency. With some thought and practice, hams can maintain and improve their reputation as a valuable national disaster resource! ■

References Equipment/Accessory Sources

GLB Electonics, Inc.
151 Commerce Parkway
Buffalo NY 14224
PH: (716) 675-6740

ICOM America, Inc.
2380 116th Avenue, N.E.
Bellevue WA 98004
PH: (206) 454-7619

NEC Home Electronics (USA) Inc.
1401 Estes Avenue
Elk Grove Village IL 60007
PH: (312) 228-5900

Aftermarket Equipment

The Lithium battery pack kit for the ICOM is available for $99 (US) from:

MoliKit
PO Box 2460
N. Burnaby BC Canada V5C-5Z1
PH: (800) 663-6658

The "Ham Sack" is a padded carrying case for a hand-held. It's nicely-made with zipper compartments for spare battery pack and antennas and connectors. It's available for $12 from:

Frank and Linda Reed
15 Daniel Webster Highway
Hudson NH 03051

The RAM expansion for NEC 8201A or Radio Shack M-100 for $20/8K, and the battery-operated printer for $99, are available from:

Purple Computing
420 Constitution Avenue
Camarillo CA 93010
PH: (800) 732-5012

The "SafeSkin" flexible waterproof keyboard cover is available for $30 from:

Merritt Computer Products, Inc.
2925 LBJ Freeway, Suite 180
Dallas TX 75234
PH: (214) 942-1142

Number 10 on your Feedback card

73 Review by Bill Clarke WA4BLC

Kenwood TS-140

Trio-Kenwood Communications
1111 West Walnut St.
Compton CA 90220

Price Class: TS-140S:	$ 900
YK-455C-1 CW filter:	90
TU-8 tone unit:	37
IF-10C interface kit:	45

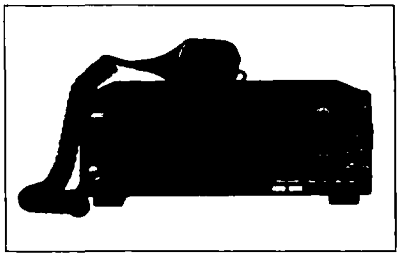


Photo A. The business end of the TS-140S (courtesy Kenwood USA).

Top-of-the-line radios are expensive, and the prices seem ever increasing. Kenwood-Trio, however, attacks the high price of high quality HF gear with the TS-140S.

The TS-140S is the first low-cost HF transceiver produced by Kenwood in several years. It is light weight, small-sized, full-featured, and all solid-state. Although a fine rig for mobile operation, many 140s will find warm homes in shacks.

First Impressions

The TS-140 is Kenwood gray, of course. It weighs in at just 13 pounds. Its 36 front-panel controls are laid out in a handy manner, and the display is much more than just digital frequency read-out.

The nice features include RTTY, Packet, AMTOR and optional FM operation; UP/DOWN microphone buttons for scanning and tuning; full-break keying; selectable AGC; 20-dB attenuator; speech processor; VOX; and adjustable RF power output control.

The built-in speaker, although quite small, provides very nice audio.

Operating Impressions

Before operating the TS-140, I read the entire instruction manual, especially concentrating on the memory operations. I highly recommend a new 140 owner to do this.

Every button and control operates easily and crisply on the TS-140S. At first the main knob tuned too lightly for my taste, but a simple twist of the knob's collar weighted properly.

The rear panel has the VOX controls, antenna and ground connections, key and external speaker jacks, and several accessory plugs for remote control, optional antenna tuner, and other functions.

Receiver

The blue-colored digital frequency read out is part of the 140's display panel. I find it easier on the eyes than some of the red LED or green LCD displays seen on other radios. Other information (VFO in use, memory position, RIT, mode, scan, etc.) shows on the main display in an assortment of red, blue and yellow colors. All are very readable.

Kenwood still includes the option of a 10-Hz read-out on the digital frequency display. The user can select this from the front panel. There is no need to open the rig and make any internal modifications.

The tuning rate is 10 kHz/revolution of the VFO tuning control. This seemed too fast, and five kHz per turn would be suitable. Fast tuning is done by using the Memory Channel knob. Tuning rate for the Memory Channel knob is 10 kHz per click, which is 240 kHz per turn. At first the idea of using two knobs for tuning seemed complicated. After the initial 30 minutes of use, however, I found it quite natural.

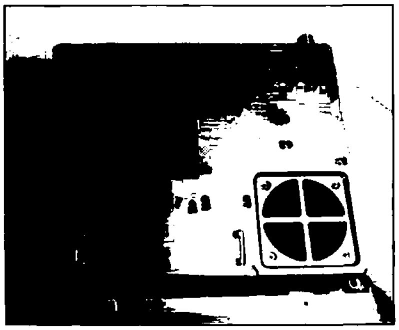


Photo B. The RF deck folds out from the main chassis for service. Note the large heat sink.

The memory scheme used on the 140 is a little complicated. There are 31 memories, broken into banks of single frequency, split frequency, programmed band marker, and scan. The manual explains clearly their use. I had no problem programming them from the very first entry.

The TS-140S has almost all the necessary filters built-in. Only the 500 Hz CW filter is optional. IF shift is included, which works well to augment filtering for interference reduction. It is detented at the zero point.

The receiver is very quiet and doesn't get too excited by background static. It is almost as quiet as the Ten-Tec Corsair. I found reducing the RF gain made receiving quieter when conditions were very noisy. This is normal with all sensitive receivers, and the 140 is very sensitive.

The 140 has two noise blankers. The first attenuates "woodpecker" noise, and the other attenuates other pulse interference, like ignition noise. They both are very effective, even with household noise generated by fluorescent lamps and some light dimmers.

The TS-140 has both band and memory scan. Scan speed is adjustable from the front panel. The operator can also manually scan memories by pushing the UP/DOWN buttons on the mike.

USB/LSB selection is made by the rig but may be over-ridden by the operator. The user can also select fast or slow AGC action.

Transmitter

Like most current rigs, the TS-140 has two VFOs, a nice touch for working SSB and CW splits. The two VFOs also allow split-band operation. Also, the 140 is easily modifiable for use on MARS frequencies. Modification is required, since the CPU doesn't allow transmitting outside the ham bands.

The TS-140S sports semi- or full break-in keying. QSK operation was great. It could be broken with a dit or two. The CW note had good reports.

I received consistently good audio reports on SSB. Each indicated excellent quality voice transmissions. None stated I was overdriving the rig. All contacts were made using the standard microphone supplied with the radio.

I've Got Memories

The TS-140S has 31 memories to complement the two VFOs. The memories are changed from a knob on the front panel or with the microphone UP/DOWN buttons. A user can program the mode in all memories.

There are four types of memories.

- Eleven single frequency memories are used for receive and transmit.

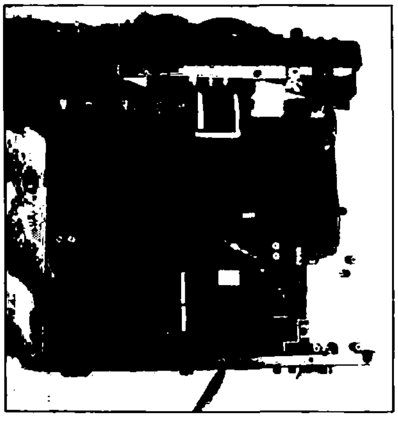


Photo C. Bottom board of the 140 shows the computer-like layout.

•Split frequency. There is a frequency in this memory for transmit and another for receive. This is most useful for 10-meter FM repeater operation, and split DX. If the same frequency is entered for both transmit and receive, then a split memory will function as a normal memory. There are 10 split memories.

•The programmed band marker. The user enters upper and lower band limits in this memory. A Novice, for example, may wish to enter 28.300 MHz and 28.500 MHz as the two band limits. From that time forward, when that memory is selected, turning the VFO knob will change frequency, yet excursions will automatically be kept within the limits of the programmed band markers. Continuous tuning will cause the frequency to stop at the end of the programmed limit and restart at the other end of the limit. There are ten programmed band marker memories.

•The last memory contains band scan limits. These are the highest and lowest frequencies that will be scanned. Of course this memory may be used as a standard memory if both frequencies entered are the same. There is only one scan memory.

Inside the 140

The inside of the TS-140 is a complete departure from all Kenwood HF equipment built to date. The unit is made of two circuit boards and an RF deck. The latter hinges away from the main chassis for service.

The first thing I noticed upon opening the 140 was that there were very few interconnect wires. Most interconnections are handled with ribbon cable. This results in a very uncluttered interior. At the side of the top board is a place to install the optional CW filter.

The computer-style interconnections and well-planned circuit board will lead to excellent reliability. At the very least they promote easy service.

Bench Testing

Bench testing is the only method of checking a transceiver's specifications against those published by the manufacturer. I completely checked the 140, and it met or surpassed all published specifications (see sidebar).

The following equipment was used in checking the performance of the TS-140S:

Leader LDC 8243 Frequency Counter
Marconi Instruments 2022 Signal Generator
Hewlett Packard 606 HF Signal Generator
Hewlett Packard 651A Audio Generator
Bird 43 Wattmeter
Hewlett Packard 8551B/851B Spectrum Analyzer
Cushman CE-5 Monitor
Tectronics 475 Oscilloscope

Remember that the performance of currently available amateur transceivers generally exceeds the capabilities of the human ear, propagation, and atmospheric conditions.

Drawbacks

The instruction manual for the 140 is complete and contains many charts and diagrams. It's generally easy to understand. A few instructions, however, are written incorrectly.

I was particularly disturbed at the incorrect instructions for IF SHIFT, Tuning Knob VFO, and Mobile Antenna Tuning. Even worse was the mention of bonding the accelerator for mobile noise reduction. The latter could prove to be very dangerous.

Kenwood USA is now aware of these conditions. Hopefully they will soon improve their manual for the 140.

The 140 has no notch filter, but I didn't miss it. Past experience has shown me that notch filter controls are too sensitive to set quickly. In lieu of built-in notch filtering, I use the Datong Automatic Notch Filter. The later is something no modern station should be without.

Keypad direct frequency entry is another modern innovation I have come to like on another rig (ICOM IC-761). I plan to use the Stone Mountain Engineering QSYer for keypad direct frequency entry on the TS-140S.

The slide controls on the right side are delicate to operate, but they are usually only irregularly adjusted.

Amplifier users need to open the rig and set a switch to the ON position. This switch activates the relay coil for the remote contacts. Kenwood says they leave it in the OFF position to reduce operational noise. Even when on, however, neither the relay nor the cooling fan on the final amplifier is very noisy. Its operation is barely noticeable.

Many of the front panel selections provide feedback with beeps, which I found annoying. The beeps are CW for the modes and alarms. Blind operators may find this feature a bonus, however. Some can be turned from the panel. All can be silenced by an internal adjustment.

Wrap-up

Would I recommend the TS-140S? Yes! It has all the necessary features of the heavyweights and is certainly a very capable transceiver, yet the price is remarkably low. Don't think low price means low quality. The 140's price brings the features and capabilities of expensive rigs to financial reality.

Would I personally purchase a TS-140? As a matter of fact, I did.

Thanks to the folks at the Electronic Equipment Bank of Vienna, Virginia, for the loan of a new Kenwood TS-140S, and the use of their very complete test bench. 73

KENWOOD TS-140 SPECIFICATIONS (as stated in the manual)

GENERAL			
Frequency Coverage:	Receive:	50 kHz to 35 MHz	
	Transmit:	1.8	2.0
		3.5	4.0
		7.0	7.3
		10.1	10.15
		14.0	14.35
		18.068	18.168
		21.0	21.45
		24.89	24.99
		28.0	29.7
Modes:	SSB/CW/FM/AM		
Frequency Control:	CPU-based 10 Hz step digital PLL synthesizer		
Frequency Stability:	± 10 PPM (parts per million) (14 to 140 degrees F)		
Antenna Impedance:	50Ω		
Power Requirements:	12 to 16 VDC (std. is 13.8 VDC)		
Dimensions:	11 1/16 x 4 7/32 x 12 inches		
Weight:	13.4 lbs.		
RECEIVER			
Circuitry:	Double conversion superheterodyne		
IF Frequencies:	1st IF	40.055 MHz	
	2nd IF	455 kHz	
Sensitivity: SSB/CW	for 10 dB S/N		
	500 kHz–1.62 MHz	less than 3.98μV	
	1.62 MHz–30.0 MHz	less than .25μV	
AM	for 10 db S/N		
	500 kHz–1.62 MHz	less than 39.8μV	
	1.62 MHz–30.0 MHz	less than 2.5μV	
FM	for 12 db SINAD		
	21.5 MHz–30.0 MHz	less than .35μV	
Squelch Sensitivity:	less than .32μV		
Selectivity: SSB/CW	2.2 kHz/ −6 dB	4.4 kHz/ −60 dB	
AM	6 kHz/ −6 dB	18 kHz/ −50 dB	
FM	12 kHz/ −6 dB	25 kHz/ −50 dB	
Audio Output:	1.5 W at 10% distortion into an 8 ohm load		
RIT Range:	± 2.5 kHz (20 Hz step)		
TRANSMITTER			
Output Power:	SSB	110W PEP (160–15 meters)	
		100W PEP (12–10 meters)	
	AM	40W	
	CW	100 W (160–12 meters)	
		95W (10 meters)	
	FM	50W (10 meters)	
FM Deviation:		± 5 kHz	
Spurious Emissions:		less than −40 dB	
Carrier Suppression:		greater than 40 dB	
Unwanted Sideband Suppression:		greater than 50 dB	
Microphone Impedance:		500–50kΩ	

Bill WA4BLC regularly reviews amateur equipment for 73 Magazine. His address is Box 2403, Falls Church VA 22042.

Number 11 on your Feedback card

73 Review

by Pete Putman KT2B

ICOM IC-900 Multi-band FM Transceiver System

The World's most advanced mobile transceiver.

ICOM America, Inc.
2380 116th Ave NE
Bellevue WA 98004

Price Class: Fiber optic basic controller unit: $590
Band units: $295–349

Where is it ?!

This is one of the most unusual product reviews I've ever written. It concerns a mobile 6-band (10m, 6m, 2m, 1.25m, 70cm, and 23cm) transceiver that. . . well. . . uh, isn't visible! Provided, of course, if it's installed as ICOM intended, in five different places with interconnecting cables and a fiber optic link between the two main chassis.

Using the IC-900 requires a radical change in thinking. The concept of remoting the bulk of the radio to the trunk or under a seat isn't new. This idea dates back to older GE ProLine and Motorola mobile transceivers with separate control heads. Although the IC-900 involves connecting three separate chassis and outboard accessories to make it work on one band, *additional* bands can be added in no time at all.

Photo A shows the individual units that make up the IC-900 system. (Take a close look—you won't see them again.) The key component is the controller, a small black box that is 5 ⅞" W X 2" H X 1" D. ICOM supplies both a rigid bracket and plenty of Velcro fasteners. The Velcro system is ideal for easy removal in a vehicle.

The controller displays a wealth of information, including dialled frequency, memory channel, repeater offsets, signal strength, and subtone actuation. The display is a soft backlit near-turquoise green, pleasing to the eye and easy to read. It also displays the receive frequency of the second selected module, if turned on.

The compact front panel keyboard sports a wide range of functions.

- •Power On/Off;
- •VFO selection;
- •Memory Recall;
- •Sub Band Switch;
- •Main/Sub Band Selector;
- •Hi/Low Power;
- •Call Channel;
- •Memory Write;
- •Tuning Step;
- •Tone Squelch;
- •Duplex/Simplex;
- •Subtone Switch;
- •Reverse Switch;
- •MHz Tuning; and
- •Set Switch (parameters).

The remaining tiny button mutes the audio of the Sub Band.

There are almost too many buttons crammed onto the front panel. The main tuning dial, however, lies just to the right of these pushbuttons, and it's plenty big enough to easily grasp. The Volume and Tone controls are another story. They are dual pushbutton mode controls, with the left side lowering the squelch threshold/volume and the right side raising threshold/volume. While any of the four are depressed, a visual display shows the increment of squelch or volume selected. A clever idea—for a base station. I find that more conventional controls are considerably easier to use in a mobile situation where you often perform most functions by feel—not by sight.

At this point, the reader may wonder how all those controls fit in that little box. They don't, but the sophisticated microprocessor controls allow for multiplex signalling via the supplied three-wire miniature cable. This connects from the controller to Interface Unit A.

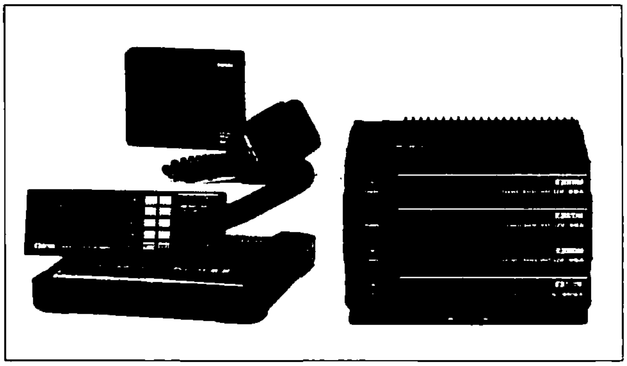


Photo A. A three-band IC-900 package. When properly installed, the only visible portions of the radio are the LCD control unit and microphone. The display unit is easily removed for extra security when parked.

Interface A

This is designed to fit under the driver's or front passenger's seat, and provides the microphone, speaker, and Interface B connections. This is the "brains" of the IC-900 system. Its microprocessor takes the command signals and actuates the necessary band units, controls two different audio outputs and squelch settings, and keeps track of main band and subband selection.

A bracket secures Interface A under either seat. Either physically bolt this bracket to the car chassis or just let it float under the seat. The microphone has a special multi-pin jack at the end of an extension cable which is secured near the center transmission area. The supplied HM-14 then connects at that point. (This is not a DTMF microphone, by the way.) Interface A also has two mini-jacks for speakers. The first monitors the main selected band, while the second works on the subband. Only one speaker comes with the IC-900, and it connects to the Speaker A jack.

Aside from these connections and the mini-jack connection to the main controller, there is a DC power cable and the unusual fiber optic cable to Interface B. All low-level signalling to change bands and set frequency and power levels occurs through this line. ICOM strongly cautions against bending or cutting the fiber optic link, and more than enough cable is supplied to make any conceivable connection. I suggest looping the unused portion near Interface B and securing it with a twist tie.

Interface B

Consider this black box as the "analog" part in this "digital/analog" combination. It directly powers up and supplies operating voltages to the various band units. Only the optical fiber cable from Interface A and a heavy DC power cable to the car battery connect to this unit. Interface B is considerably heavier than A and should be very securely

fastened somewhere in the trunk or rear of the vehicle.

The front of Interface B contains a removable panel that allows interconnection of the various band units, and there are plenty to choose from, according to the owner's manual. When I received the test unit, the only module available was the UX-29A 2 meter module. Since then, other models have been introduced for operation on 28 MHz, 50 MHz, 220 MHz, 440 MHz and 1260 MHz. A small joint cable is needed between the selected band unit and Interface B. A front-panel LED verifies that power is on.

Finally, the UX-29A and other band units nestle atop Interface B and can be secured to it with the supplied brackets. Incidentally, these brackets look as if they'll allow up to three band units to be chained together, so more brackets would be required to enable additonal bands. As I mentioned, the short ribbon cable connects the first band unit to Interface B. Each added band unit daisy-chains to the preceeding one with a similar jumper. Finally, a short length of coax with either type N or UHF connectors mates with the antenna of your choice.

Photo B. Interior view of the 1987 Toyota Corolla LX, showing the IC-900 control head and microphone. The main interface lies underneath the driver's seat. The rest of the system is in the trunk.

Impressions

Still trying to make sense of all the previous paragraphs? I'll admit I spent a few hours staring at all of these interface units, wires and lots of hardware trying to make sense of it. After all, I reasoned, why would anyone want to spend the extra money to wire all of this into their car just to get on 2 meters? Deb Davis at ICOM said, however, there is, indeed, a demand for a remote, hide-away multi-band FM transceiver, and ICOM has tried to satisfy this market in their best fashion.

I installed the IC-900 in a brand new 1987 Toyota Corolla LE Sedan. Careful study of the Corolla interior revealed a path through which to route all the cables without drilling any holes. The key was the fold-down split seat-back in the LE, which allowed access to the trunk.

Interface B and the 2-meter band unit snugged alongside the left rear wall very well. However, I did loop the remainder of the fiber optic cable alongside the combination and tied it with a twist tie. Interface A nested under the driver's seat, left unsecured since the area around the unit prevented any lateral motion. The microphone extension attached to the transmission housing with the supplied bracket, and the speaker fit all the way to the rear of the lower map/change tray.

Figure 2 shows the end result. The microphone rests inside the lower compartment and the controller sits on the dashboard. Nothing else is visible. An alternate postion for the controller is atop the dash directly behind the steering wheel—not in the line of vision, but easy to get at.

My wife Gayle KA9ESB at first suspiciously regarded the IC-900 controller. She soon discovered, however, that she could pre-program ten different repeater and simplex channels for instant access—just by tuning the large black knob. One need not know much about the radio to perform that function! Most of the time, we use four or five channels for local work.

When one of the repeaters nearby went to subtone access to alleviate a co-channel interference problem, she used the SET key to select the 151.4 subtone and load it into that memory channel. Piece of cake.

Receiver produces PLENTY of audio volume for even the loudest interiors. The catch is remembering where it's set, since the operator has to depress the volume buttons to get the displayed increment. The same goes for the squelch—ordinarily left alone—during tropo conditions. The memory channels are a must in heavy traffic. There's no time to look at the display and program all of the necessary buttons for the selection.

The pushbuttons themselves are somewhat difficult to read unless the operator sits right in front of the controller. The backlighting doesn't make it any easier at night.

I used the IC-900 on several long trips last summer and received excellent audio reports through at least 10 different repeaters. The receiver is on a par with any FM mobile transceiver I've ever used, and the signal strength indication is fairly honest. After many miles on both smooth highways and a fair amount of bumpy roads, the trunk-mounted Interface B and UX-29A band unit don't appear any worse for wear. Power output at 146.000 was measured at 25 watts when I installed everything, and it was still 25 watts 3 months later.

One feature not tested here is the dual receiving mode, which allows simultaneous listening to both main and subband units. Of course the operator can mute the subband receiver when the main band is in use. Any two-band unit combination is configurable this way from the controller. An accessory duplexer is available for simultaneous 146/440 MHz operation with one antenna.

Conclusions

The road tests showed the IC-900 receiver to be as good as many contemporary mobile transceivers I've had the chance to use.

There are a lot of credits to the IC-900. One of them is the ability to hide the bulk of the radio in the trunk. On the other hand, comparable small-sized 25-watt mobile transceivers abound on the market for considerably less money than the IC-900. Budget-minded folks should check out the next paragraph.

$$$ Comparison

The interface units and controller sell for $590 list, according to a Fall '87 catalog from one of the largest retailers of ham equipment. This is just the set-up sans band units! That kind of money can buy an IC-28A with a few accessories.

The UX-29A 2 meter band unit sets the ham consumer back another $295. This adds up to $885 just to get on 2 meter FM with 25 watts. The cost per band decreases, however, as additional band units are added. With four or more band units, the IC-900 may make economic sense. Besides, most people haven't room in their car for two, much less four radios, and the IC-900 can fill their needs.

The IC-900 is, indeed, a clever radio design and very reliable. It's easy to use once configured, but I don't recommend dialing up frequencies or programming while driving! The keypad is difficult to read under most conditions. The main tuning is easy to use and the display rates very highly as far as information and readability.

Should one buy an IC-900? If multi-band FM operation and rig inconspicuousness are priorities, then the IC-900 is worth considering—if price is no object.

The IC-900 represents a quantum leap in amateur transceiver technology, and is probably the ultimate FM operating system ever seen in this country.

Number 12 on your Feedback card

Stop, Look, and Listen!

A shortwave program guide unlike any before it.

Passport To World Band Radio
International Broadcasting Services, Ltd.
400 Pages, $15

reviewed by Larry Ledlow, Jr. NA5E

Just a short time ago, shortwave broadcast listeners (SWLs) in this country were few and far between. Many SWLs had discovered the rich and varied programming available on the HF bands while traveling or living overseas. Still others (like myself) found SW broadcasters quite by accident. I first heard the Voice of America as intermodulation on an inexpensive radio I had received for Christmas. Many hams have long known shortwave broadcasters as little more than sources of great consternation, especially on 40 meters in the evening.

Twenty years ago SWLs were a small, slightly eccentric group, but no longer. More and more people discover SW listening every day. Most modern ham transceivers receive all of the HF broadcast bands. Sony, Panasonic, Grundig, and other electronics companies market quite affordable portable SW receivers. These manufacturers have responded to the increasing interest in SWLing, which has largely come about from John Q. Public's boredom with American network offerings. In general, too, we are moving towards a global community. The public's interest in international affairs has increased accordingly.

A Handy Program Guide

Listeners can't just pick up the local newspaper to check the transmission schedules of Radio Moscow or the BBC. Until recently, SWLs relied on direct mailings from broadcasters and the annual *World Radio TV Handbook* from Billboard Publications for schedule information. Several years ago SWL extraordinaire Larry Magne and company created *Radio Database International*, which provided a comprehensive list of hundreds of shortwave broadcasters' schedules.

In 1988, there is a much improved RDI offering, Magne's *Passport to World Band Radio*. The "in" word for shortwave broadcasting these days is world band radio. As the title implies, *Passport to World Band Radio* offers both new and experienced listeners an excellent and easy-to-use guide to shortwave broadcasting. More than just a schedule listing, the book offers fantastically useful information on receivers to buy, antennas, and more. *Lots* more!

Don Jensen gives an interesting essay on Jackie Gleason's SWL interests. Canadian broadcaster Ian Macfarland discusses broadcasting north of the border. News and weather hounds learn where to tune for the best reports on the air. Read a frank profile of Vladimir Posner, a well known Radio Moscow announcer. Maud Blankson-Miles takes readers to Ghana and then tells them how to listen to that West African country. China offers a fantastic mix of world band broadcasting, as Bob Hill discusses in his essay. Anyone care to tango? Check out *Passport's* guide to traditional Latin American music.

The book dedicates 43 pages to dozens of receiver ratings and detailed reviews for the most popular models. Newcomers to shortwave listening will appreciate the frank evaluation of these radios. Larry Magne and RDI have impeccable reputations and will not lead would-be buyers astray.

Of course, the heart of *Passport to World Band Radio* is the blue page section. The blue pages, all 255 of them, provide information on broadcasters' schedules, languages, power, and target areas from 2300 to 21605 kHz. The book's ingenious encoding scheme clearly illustrates all of this information. Not much mystery here. The schedule guide is exceptionally easy to use.

Want to know when Radio Zambia broadcasts in English? Just turn to the "World Scan" guide preceding the Blue Pages and find 9505 and 11880 kHz. Turn to 9505 kHz in the blue section and note Zambia keeps an irregular schedule between 1600 and 2100 UTC. Their programs are beamed to southern Africa. The world at the flip of a few pages.

Passport to World Band Radio has a slick, modern look. It is rightfully aimed at an audience far broader than the SWLs of old. The number of world band radio listeners is growing more rapidly than ever before. Some soothsayers predict more than half of American households will have shortwave broadcast receivers by the next decade... and that's just around the corner!

Passport to World Band Radio is here to meet increasing demands for timely information of and from the busy world around us. It satisfies those needs like no other book can. Travel to foreign lands has never been eaiser. Just turn a page and spin a dial... and don't forget your *Passport*. 73

Most shortwave broadcast stations transmit on frequencies agreed upon by members of the International Telecommunications Union (ITU). Some out-of-band broadcasts occur, but most fall within the following frequency ranges.

120 meters	2300–2498 kHz	Tropical countries domestic service
90 meters	3200–3400 kHz	Tropical countries domestic service
75 meters	3900–3950 kHz	Pacific and Asia
	3950–4000 kHz	Outside the Americas
60 meters	4750–4995 kHz	Tropical countries domestic services
	5005–5060 kHz	Tropical countries domestic services
49 meters	5950–5060 kHz	
41 meters	7100–7300 kHz	Outside the Americas
31 meters	9500–9900 kHz	
25 meters	11650–12050 kHz	
21 meters	13600–13800 kHz	
19 meters	15100–15600 kHz	
16 meters	17550–17900 kHz	
13 meters	21450–21850 kHz	
11 meters	25670–26100 kHz	

Hams may find shortwave listening useful for their own operations, too. Activity on the SW bands may indicate current or impending ham band DX openings. Further, many stations feature propagation reports and DX programs. Some SWL clubs and stations offer various achievement awards. Most broadcasters confirm SWL reports with QSL cards, too. Numerous stations offer on-the-air language and culture courses, and still others provide useful radio computer programs to listeners. Try it. You just may like it!

Number 13 on your Feedback card

Advanced Electronic Applications
P.O. Box C2160
Lynnwood, WA 98036
Price Class: $25

73 Review *by Mike Stone WB0QCD*

AEA PK-FAX Software

Push PK-232's FAX to the max.

Interest in amateur radio and commercial facsimile communications is growing steadily.

In late summer of 1987, AEA (Advanced Electronics Applications, Inc.) of Lynnwood, Washington, decided to make a major improvement to the FAX mode in their popular PAKRATT PK-232 data controller. The PK-232's FAX receive mode was limited to dot-matrix hard-copy printouts. AEA hired Steve Stewart, a free-lance computer hacker in California, to develop "PK-FAX," a program that also sends a composite video signal to the monitor. It's packed with bells and whistles.

"PK-FAX" is for those who have AEA's PK-232 or (Heathkit's) HK-232 terminal data controller, at least a January 1987 PC-PAKRATT software update, and an IBM PC or clone. The PC must have at least 256K of memory, two floppy disk drives (or one floppy and a hard drive), DOS 2.0 or above, an available serial port (and card), a serial cable capable of 4800-baud operation (included with PK-232 unit at purchase), and a receiver. Users can also enhance the program's usefulness with a dot matrix printer capable of bit-graphics, a parallel port, a Paintbrush™ (ZSOFT Corp.) program, and a transceiver. There may be one or more software upgrade version before Dayton in late April. The software package costs $24.95.

Start Up

First, copy PK-FAX on to a disk with a PC Paintbrush (Microsoft Paintbrush, Logi Paint, etc.) program. A hard disk is very helpful here. A hard disk can store many more FAX pictures than a floppy disk drive, and the user can then take full advantage of the neat AUTOSAVE feature.

A 5-¼ inch floppy can store 6–7 pictures. I requested AEA to provide some sort of a image directory callup within PK-FAX. The test program required an exit to DOS for a directory list.

LOAD the program by entering PKFAX> (not the brackets). An initial Menu will ask for:
•(C)onfiguration
•(Y) FAX receive/transmit - disk and printer
•(N) FAX, disk and printer
•E(X)it

The configuration option lets users customize the PK-FAX control program applications. The program lets the user select serial port, printer port status, baud rate to printer (300–9600), parity, printer designation, graphics density (120 dbi default), and video graphics type. PK-FAX will support Epson, IBM, Radio Shack, Apple (G) or (S), Okidata, Star Gemini or Micronics, GX-100, Gorilla Banana, Texas Instruments, Genicom, NEC, and miscellaneous printers. Also, the user can select Hercules or IBM Color (CGA or EGA), graphics, a six-character Morse ID, and AUTOSAVE start and stop times.

The (Y) command starts the PK-FAX program to set up communications with the PK-232 unit. Once initialized, the TV monitor goes to black except for a white status line indicator at the very bottom of the screen. This very helpful status line indicator displays mode and status while operating the PK-FAX program features. This STATUS line includes F1 (HELP), LPM (default 120), IOC (Index of Co-operation or Aspect ratio, L-R (Scan direction adjustment), buffer (full or empty), time clock, percentage (transmit/receive percentage sent or received) and Mode (STBY or SYNC). On the Nov. 20, 1987, software upgrade, the F1> key now gives a quick on-screen HELP MENU window. Any picture in memory is unaffected by the window.

> ***"PK-FAX is a program that sends a composite video signal to the monitor."***

Tuning in on FAX

FAX is transmitted using a 800-Hz shift. The PK-232's filters require a signal tuned to a 1.7 kHz center frequency. The PK-232 bar-graph display aids correct tuning. With a signal properly centered, remove the PK-FAX program from STBY to SYNC (receive active) by hitting the Y> key. B> returns PK-FAX back into STBY. The L> key cycles through 60, 90, 120, 180 or 240 LPM scan rates.

The I> key determines the aspect ratio. IOC 288 (one out of 3 lines) is for WEFAX satellites, IOC 352 (one out of 2 lines) for wire photos, and IOC 576 (2 out of 3 lines) for weather charts.

The D> key controls the pictures scan direction (LEFT to RIGHT or RIGHT to LEFT.) Some foreign images come backwards to USA viewers, so this control becomes quite useful.

The up/down or left/right ARROW keys brings an on-screen target cursor. This cursor identifies the edge of the picture for automatic justification and image alignment with the J> key. This image is then saved to disk. Unlike less sophisticated programs or FAX hardcopy machines, the PK-FAX user can manipulate the image on screen for perfect realignment at any time. The Control>V> key toggles the incoming or captured picture in reverse B/W form.

The actual video display can show only two-thirds of the captured picture at a time. Page up> and Page down> keys allow the viewer to look at either the top or bottom two-thirds of each picture. The END> key shows a 0.67 (or two-thirds) reduced picture. Hitting the HOME> key gives the viewer a 4X zoom presentation. PK-FAX allows LOOK and ZOOM anywhere in the captured picture by using the ARROW keys. The true "whole picture" and best resolution comes out when the captured picture is printed on a dot-matrix printer. Keep on hand a hefty supply of well-inked ribbons!

To SAVE captured pictures, hit the W> key and give a file name. To retrieve an image from disk, hit the R> key and give the filename. The special AUTOSAVE feature lets the user program start and stop times, so the computer will automatically record and save FAX images. Weather stations normally adhere to a transmission schedule with maps and photos sent at the same time every day. AUTOSAVE makes unattended reception of particular items of interest a snap.

Transitting FAX Pictures

In a word, simple! Just hit the T> key, and that's it! The STATUS line indicator at the bottom of the screen goes from STBY RCV to STBY SEND. The PK-232 interfaced to a VHF or HF radio sends out a black tone for 5 seconds, then START sync pulses (5% white) tone for 30 seconds, and finally the FAX contents of the picture. It usually takes anywhere from 8 to 13 minutes to transmit a full FAX picture.

The program can use Paintbrush-type programs. This opens the door to computerists who want send more than just captured weather-type photos! First save the pictures in a 1280-dot by 400-dot screen. A program called FRAME reduces or rotates pictures to a more convenient form for the Paintbrush program.

The FCC authorizes FAX transmission on all amateur HF, VHF and UHF bands except 160 meters. 14.240–14.245 MHz is the best place to find other world-wide FAX operators on 20 meters.

I anticipate amateur radio facsimile to blossom in the next few months as more and more AEA customers and PK-232 owners obtain the new PK-FAX software. A whole new group of sending and receiving facsimile enthusiasts is about to be born, and we have the fine people at AEA to thank for opening up this opportunity! If you see me smiling a lot this year at Dayton, it's because I have an informed feeling for what directions AEA is heading next with yet another great technical accomplishment! Stay tuned and "see you" on the Net!

Bicycle-Mobile Packeteering

It's time to pull packet radio out of its infancy!

by Steven K. Roberts N4RVE

My ramblings hardly seem like a bicycle trip. It hardly even seems like TRAVEL sometimes, with the familiar intertwined layers of Dataspace swirling around me no matter where I roam. Whether clipped into a modular jack in Jackson, hunkered down at a pay phone in Phoneton, or prowling through NET/ROMs from Netcong, I always feel a sense of connection with my stable electronic community. Somehow, the pedaling interludes seem but playful diversions—an endless source of tales and insights to keep those keyboard fingers exercised while living comfortably in Dataspace.

The network world is home alright, but culturally, the amateur packet community is still in its infancy. For well over a decade, a complex society has been developing in the large computer networks, prowled not only by the original hackers but by a diverse cross-section of humanity.

I mention all this because hams possess a unique set of tools quite the envy of traditional networkers everywhere. Yet hams have hardly begun to develop the "nth-layer protocols" that govern style and behavior...the essential underpinnings of human culture. Instead, we get ***connected and talk about our technology or offer hardware for sale. Very few true personas have emerged—for fame in the packet community comes instead from authoring a BBS package or owning a big-gun digipeater.

I propose that we make every effort possible to outpace the limitations of our demographics and use these new tools to build an electronic neighborhood.

Every network has to graduate from a period of self-examination to survive. In the early on-line days, there was an obsession with "who we are" and "what all this implies." I remember rhapsodizing into the night on the CompuServe CB simulator, releasing real-time pheromones into the cosmos and tossing thoughts through my electronic window, pausing every few minutes to comment to unseen friends about the magic of this medium. We soon became as gods, dancing through the ether in porpoise-playful alacrity, weaving and bobbing among the indelicate compu-boors and DUMB-TERMINAL USERS WHO ALWAYS SEEMED TO SHOUT ALL THE TIME. There was an endless buzz of intellectual energy, for we recognized in ourselves a species a-borning.

Then we matured, forming subcultures within subcultures, and life on-line became every bit as real as real estate. When I finally sold the house and moved to a bicycle, there was nary a glitch in my sense of home.

And it wouldn't BE home if it weren't robust, diverse, and infinite in possibilities.

Packet radio grows now on the fringes, enabling another major step in disconnection: the elimination of a wire umbilicus to the closest network node. We have the technology to make a major impact...but do we have the culture? Do we have the diverse range of intellects, the crazies, the impostors, the mad flamers, the playful hackers, the sexy prowlers? Or is packet destined to remain a mix of practical messaging, public service, point-to-multipoint technical exchange, forum for its own documentation, and DX frontier for those burned out on HF contesting?

It's up to all hams. Here's a suggestion: When on packet AND on a big network, take steps to download culture as well as software. Inject network style and commentary onto 145.01; seduce wire-bound networkers into our lair. Proselytize. Build a gateway. Put your SELF onto packet, not just the equipment. Bring women online and flirt with them electronically. Play with software-controlled multi-connects and build multiport conferencing systems to speed things up. And then...let the madman inside come out to frolic in the comparative anonymity of life online.

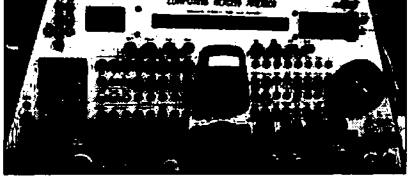


Photo A. The Winnebiko's packet station uses a Pac-Comm Micropower-2 TNC, a Yaesu FT-290 two meter radio, and a Radio Shack Model 100 computer with its display an integral part of the bike's console.

Now...How the System works

First, the introductory overview piece in this series ("On the Road and On the Air," February 1988) is prerequisite reading for the articles that follow. Those who missed the original issue and want a photocopy, send $1 to the Computing Across America address at the end of this article.

At its heart, of course, the Winnebiko's packet system contains a TNC—the original CMOS unit from Pac-Comm (which is about to be replaced by their nifty new 40mA "Micropower-2" unit). The TNC is standard...but at all levels, its interface to the outside world is non-traditional.

The board is buried deep in the console electronics package, so its status LEDs are remoted to the control panel—along with a switch for power and another to allow a convenient loopback test. Likewise, on-board linear voltage regulators are disabled to save power, since the bike's efficient switching supplies already provide 3, 5, 6, 9, and -12 volts in addition to the twin 12-volt battery buses.

The radio interface is a bit more elaborate than usual, since the Yaesu 290 is a major communications hub in this mobile system. The TNC's push-to-talk line is ORed with both software and handlebar PTT commands before being passed on to the radio; a similar merging occurs with mike and speaker lines through a small "audio nexus board" that includes such things as preamps, a 4-pole filter, mixers, and so on. There's quite enough thought required to run the system without having to manually establish a connection between TNC and radio every time!

Serial Port

Readers may recall from February that all data communication among the bike systems takes place through a "serial crossbar network" under control of the bicycle control processor (BCP). When designing the machine, I knew that I'd want to run packet in two completely different settings: on the road while mobile, and through the HP laptop

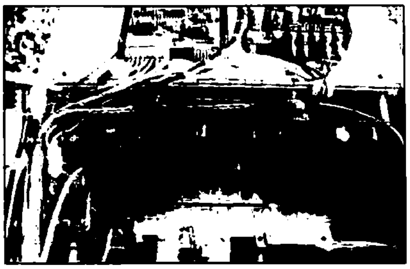


Photo B. The Pac-Comm Micropower-2 TNC, buried deep within the console, actually appears as a node in the serial crossbar network controlled by the bicycle control processor (BCP).

while parked. It was also essential that the hardware architecture allow automation of all packet functions to support the BBS as well as future security and telemetry systems.

The TNC appears as a node in the serial crossbar network, which acts as a central office for all asynchronous data floating around in the bike. This logic can be controlled by 4-bit commands from the BCP or overridden via a front-panel rotary switch. It does its job with an array of 74HC4016 analog switches wired to permit connection between all possible pairs of transmit and receive data lines... with much less overhead than a traditional LAN. From the TNC's standpoint, of course, the only meaningful connections are to the front-panel DB9 (for the HP Portable PLUS) and the Model 100.

In the simplest case, the laptop drives the TNC with no other system components powered up. Things are a little more complex, however, when I'm on the road. Three processors come alive and work together to support a packet QSO.

Besides the TNC, a heavily modified Model 100 with a tree-structured operating system (Traveling Software's Booster Pak) runs BBS and terminal software, displaying its activity on a console LCD. For the last few thousand miles, this machine has been processing under the delusion that it has a normal keyboard, but as I noted back in February, its parallel console port is tied to a chunk of interface logic owned by the BCP.

The Handlebar Keyboard

To understand how this subsystem works, it's necessary to view it in three parts: the handlebar keyboard itself, the interface software, and the the hardware that links the BCP to the Model 100.

First, there are a total of eight waterproof keys on the grips, four on each side. The connection between them and the 68HC11 board that runs the bike has become trivial. After riding a few months with a flaky hardware interface, I wised up and tied the pushbuttons to an input port through some Schmitt triggers. Why mess around with timing logic and noise-sensitive edge detection when there's a fast and lightly-loaded CPU spinning in a wait loop all day long? The BCP now polls an input port to see what's happening back on the handlebars.

The code is straightforward, more or less.

Photo C. The Model 100 accepts input from the eight handlebar keys, which are routed through Schmitt triggers. The BCP watches for activity transitions at the keyboard before further decoding.

As I type in a variant of parallel ASCII, the processor watches for a transition from "no keys down" to "any keys down." As long as that condition exists, it lights a console LED and ORs together any active bits that comprise the character to be latched as soon as "any keys down" returns to "no keys down." This eliminates any tendency toward timing-sensitivity, something that would be a nightmare on bumpy roads with Morse, Braille, or any other one-handed system requiring both setup and strobe actions.

From here, a few checks are made to see if the character is "ignore me" (FF hex) or contains bit combinations that imply a local command to the BCP itself. Then it's passed on to decoding and lookup logic. In short, this maps the handlebar character onto the Model 100's keyswitch matrix, assembling an 8-bit value that contains row address, column address, and a special bit to denote simultaneity (control, shift, graph, and code keys). This byte is then output to hardware with a corresponding flash of another console LED.

But it's not ready for the 100 yet—that machine expects a keyboard full of of passive switches in an X-Y matrix. There's an active 17-pin interface to deal with here, in which decoded column strobes are exhaled by the 100 while row data are inhaled. To emulate all this, a comparator watches the former, matching them against a decoded version of the three column bits in my synthetic character byte. When a match occurs, it causes the appropriately decoded row code to be generated... with another multiplexed into the same cycle if the key has a simultaneous modifier.

Handlebar Key/Character Setup

To keep things reasonably simple for the operator, I shuffled the handlebar bits enough to allow my five strongest fingers, working alone, to generate lower-case alpha. The right little finger causes upper case; the left, control. The left ring finger signifies numeric or special characters (hmmm) and various combinations of those three yield less-common columns on the code chart or a short library of frequently-used words. Alone, the three minor fingers produce return, backspace, and space.

The thumbs handle 2- and 11-meter PTT, air horns, and sirens. The fleshy outsides of the palms handle two of the three dimensions in the 54-speed transmission, and the entire hands abort their typing and squeeze like hell when the disc brakes are needed. There are many degrees of freedom remaining, but I need to steer and stay sane as well.

Ergonomics of Mobile Packet

Heh. It's a common question: "How d'ya concentrate on the road when running thet computer?" The answer is that the two activites occupy such different parts of my brain that virtually no wetware resource-management is necessary. (I can see it now: my last words captured in a RAMdisk file like the data in a DC-9's "black box." They peel me off a mountain, reconstruct the bike like an airplane to determine the cause of the crash, and find in a file called LSTWRDS.DOC the following text: "Aaaaauuuuggghhhhhhhhh!")

Actually, running bicycle-mobile packet is pure pleasure—and not just because of the naughty sense of beating trade-offs by inventing new rules and then ignoring them. The pace of packet radio is slow enough that the intrinsic synchrony of a handlebar keyboard (limiting me to about 30 wpm) is not as frustrating as it would be in, say, a GEnic real-time conference room. In a perverse way, it fits bicycle touring perfectly....

Imagine chatting digitally with Sourcevoid Dave, himself car-mobile, while pedaling from Palo Alto to Menlo Park. Sending mail to an Internet friend in Sweden while negotiating city streets. Patching together 15,000 miles of NET/ROM links, including two passes through the wormhole, while waiting for KA8ZYW to emerge from a store with an armload of burrito fixin's. Getting directions to W2ICZ's house in Buffalo while pumping along the Lake Erie shore. Watching out a restaurant window as the BBS accumulates mail, the bike's CON, STA, KEY, DCD, PTT, BUSY, and OK lights blinking in the dusk of an unfamiliar town as it opens its electronic doors to a tired wanderer.

Electronic communication is an essential part of today's lifestyle. My perception of ham radio changed a lot when I realized it could be much more than a celebration of technology, a medium for competition, and an off-hours hobby for those not already burned out on knobs and switches. A delicious melding is happening now—a synthesis of widely divergent technologies.

Readers who want to sample network life and have direct access to Steve and his online ramblings (over 40 chapters so far, as well as a dozen or so technical articles), sign onto GEnie. Use a modem to call (800) 638-8369, and when connected, hit HHH and wait for the U#= prompt. When it appears, type control-R followed by XJM11878,GENIE and hit RETURN. Have credit-card or checking account data ready—the system goes through a one-time sign-up and then bills the user $5/hour for subsequent non-business-hours access. Steve can be reached by electronic mail as WORDY; Larry Ledlow, the editor of *73*, can be reached online as L.LEDLOW or EDITOR73. Finally, please note that my call has changed from KA8OVA to N4RVE.

Number 15 on your Feedback card

Dx

Hams Around the World

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

New DXCC Rules and Awards

At its regular January meeting, the Board of Directors of the ARRL voted to update the DX Century Club (DXCC) rules, and to sponsor some new, single-band awards.

These changes resulted from a comprehensive study of the entire DXCC program, dating back to July 1986. At their July 1986 meeting, the Board directed the DX Advisory Committee (DXAC) to "consider the advisability of restructuring DXCC." This study was intended to be far-reaching. The Board motion said, "This group will not be precluded from considering any possibilities, up to and including even a 'fresh start' award, replacing the present DXCC."

Over the next 18 months, three subcommittees of the DXAC, and the DXAC as a whole, looked into all aspects of the DXCC program. The group solicited comments from DXers all over the world. They were rewarded with about 1500 opinion polls, comments, letters, suggestions, and ideas. The sixteen members of the DXAC then produced a carefully-considered, well-reasoned update to the entire DXCC program.

In his cover letter to the ARRL Board, DXAC Chairman John Parrott W4FRY says, "The cliche 'If it ain't broke, don't fix it,' became the battle cry of the DX community worldwide when it became known that the DXAC was studying the possibility of restructuring the DXCC program. The message the DXAC received was loud and clear: add a few more awards, clarify and simplify some of the rules, but don't change the basic program—just fine-tune it." John continues, "Many worthy recommendations were considered and discarded because they were not practical to implement or manage. Other majority recommendations, such as dropping or shelving DXCC countries that have been inactive for long periods of time, were considered as not being in the best interest of the DXCC program."

Even without making major changes to the program, the DXAC review will have considerable impact on DXCC and DXing in the future. Here are some of the new DXCC rules, and how they affect DXers.

Single-Band Awards

The new DXCC rules provide for three additional single band DXCC awards. DXers will soon be able to apply for awards on 80, 40 or 10 meters, as well as the previously existing awards for 160, 6 and 2 meters. The application deadlines for these new single-band awards will be phased in over the next year, to ease the workload at the DXCC desk in Newington. For example, applications for the 10-meter single band award will be processed starting July 1, 1988, with the 80 and 40 meters awards starting November 1, 1988, and May 1, 1989, respectively. These dates are the application dates. Contacts for each award may be made after the date of the start of post-war DXCC: November 15, 1945.

They chose the early start date specifically to reward old-time DXers, without penalizing newcomers. The League is still smarting from the outcry that ensued when they used January 1, 1975 as the start date for the CW DXCC.

There is a new wrinkle to the application procedure for these single-band awards. All previous DXCC awards were numbered in order of date the application was received. When the 160 meter DXCC started, for example, W1BB showed up early in the morning at ARRL Headquarters to be the first to submit his application, and get 160 meter DXCC #1. For these new single-band awards, the ARRL will accept applications during a two-week "window" prior to the official application date. Thus, applications for 10-meter DXCC will be collected June 15–June 30. The ARRL will then review all applications received by July 1, and award the certificates in order of most countries confirmed. The station with the highest 10-meter country total gets #1, and so on. In case of ties, the stations will get the same number, and the subsequent number will be skipped. Applications received after July 1, 1988, will be numbered in order of date received. The same procedure will be used for 80 and 40 meter single-band DXCC awards.

DXCC Country Criteria

The DXAC also clarified one of the more controversial parts of the DXCC rules: the country criteria. These are the guidelines whereby new countries can be added to the DXCC list. The DXAC eliminated some of the ambiguities and fuzzy language from the old rules, and incorporated some of the informal country criteria that the DXAC has been using for many years, but seldom published.

To determine if an entity is sufficiently independent to qualify as a new country for DXCC, some of the characteristics to be considered include membership in the UN or specialized agencies of the UN, such as the ITU; authorized use of ITU-assigned call sign prefixes; diplomatic relations with other countries and maintaining a standing army; and regulation of commerce, trade, customs, immigration, and licensing, and the issuance of currency and stamps.

Another clarification of the country criteria might be called the anti-Pribolof rule. The Alaska DX Association has been trying for years to add the Pribolof Islands to the DXCC list, on the grounds that they are more than 225 miles from the mainland of Alaska. Their petition was consistently denied, based on the presence of other islands between the mainland and the Pribolofs.

The new DXCC rules are unambiguous, and will prevent any conflicting interpretation such as the Alaska DX Association issue.

Deletion Criteria

A new section of the DXCC rules is the deletion criteria. These rules spell out the circumstances under which a country is removed from the DXCC list. Again, this is a formal presentation of a collection of informal rules that had been used for years. Among the reasons for dropping a country from the DXCC list are:

•Annexation. This is when a country is taken over by a neighboring country, such as when China annexed Tibet.

•Unification. This is when two neighbors combine under a single government.

•Partition. This is when a country is split into more than one country.

•Independence.

Accreditation Criteria

No single part of the DXCC rules causes more problems than the accreditation criteria, under which a given amateur operation from a DXCC country is accepted for DXCC credit. From the days of Don Miller's lawsuit against the League after having one of his operations not accepted, to the recent controversy surrounding Frank Turek's Mt. Athos operation, the accreditation criteria have been the center of ill feelings and misunderstandings. The DXAC fine-tuned the accreditation rules by spelling out some of the documents that would make the operation acceptable for DXCC credit. These include contract agreements with governments, details of "license" authorizations, and detailed landing information for uninhabited islands.

Other Changes

The three new single-band awards are the most dramatic changes in the DXAC report, but there are many other, more subtle updates in the new rules. For example, the DXCC rules now spell out how to get on the DXCC Honor Roll, and specify that new Honor Roll recipients will be listed monthly in *QST*. There is also a provision for a #1 Honor Roll plaque for those DXers who have worked every country on the current DXCC list. Another new rule involves OSL cards: each card must contain the call signs of both stations, the country, mode, date, time, and frequency. (Note that signal reports are not required for DXCC credit.) The DXAC recognized that the addition of new awards and more detailed rules might increase the workload of the DXCC branch.

Thus they suggested that the League investigate the possibility of having the initial 100 cards for DXCC checked by volunteers, at other than ARRL HQ., as is done for most other awards. This suggestion was send to the Membership Services Committee of the ARRL Board for further study.

The DXAC study of DXCC restructuring has cleared up many of the problems with the existing DXCC rules. Although this is unlikely to be the last word in DXCC, their efforts will have a significant impact on the DXCC program for years to come. ■

Number 16 on your Feedback card

NEW PRODUCTS

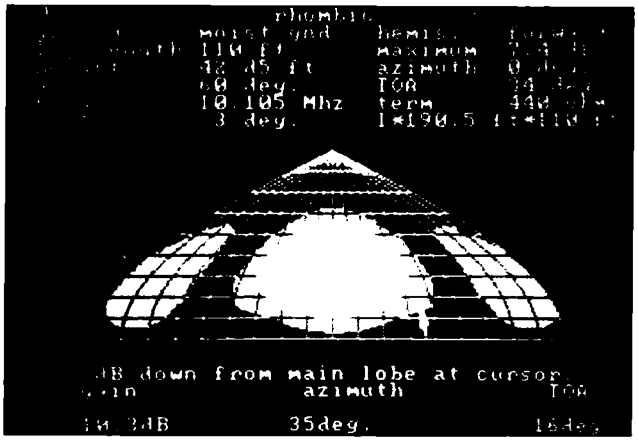
Compiled by Rebecca Niemela

PRODUCT OF THE MONTH

SR-15 SCANNING RECEIVER

Cobra announces its new miniaturized, 100-channel unit with electronic digital tuning and five memory banks. The SR-15 is a pocket-sized hand-held scanner. This unit ($300 suggested retail) features 11-band coverage for police, fire, paramedic, government, military, aircraft, business and amateur radio broadcasts. There are many automatic operating functions, including normal scan, automatic search, channel lockout, channel priority, selective scan delay, channel hold, and manual scan. Its five memory banks stores up to 20 frequencies each.

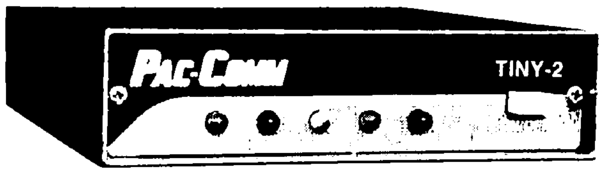
The SR-15 scanner is 6" H x 2¾" W. Accessories include flexible rubber antenna, rechargeable NiCd battery pack, AC adapter/charger, earphone, and carrying case. For more information contact: Cobra Consumer Electronics Group/Dynascan Corp., 6500 West Cortland Street, Chicago IL 60635, (312) 889-8870 or circle Reader Service number 201.



EPSILON

Epsilon is marketing a software package for the long-wire antenna experimenter called Long Wire Pro. This software allows the user to model several horizontal wire antennas and optimize their use, even before starting construction. It takes into account wire length, height, tilt with respect to the horizon, kind of ground, and (when using vees and rhombics) the apex angle, all to determine radiating lobe alignment. Using the above factors, the program generates a sinusoidal projection of radiated power. It shows the resulting pattern over a half hemisphere at a time. One sees how the lobes are formed and how they are affected by various trade-offs in design. It's astonishing how misleading the usual 2-dimensional patterns in most antenna books can be.

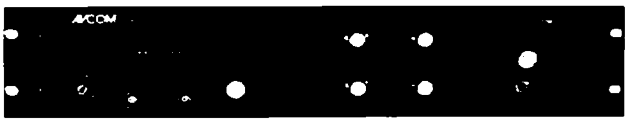
The Long Wire Pro software is $35. For more information contact: Epsilon Company, Box 715, Trumbull CT 06611, (203) 261-7694, or circle Reader Service number 203.



TINY TNC-2

Pac-Comm announces a totally redesigned TNC-2 clone, which uses unmodified TAPR TNC-2 software. This new Tiny TNC-2 uses an integrated circuit modem and simplified circuitry. This insures reliability and size reduction at a much lower cost. The 1200-baud unit includes as standard features: 32K RAM, 32K EPROM, RS-232 and TTL compatibility, watchdog timer, modem disconnect header, switch selectable terminal baud rates, and 12V DC operation. The Tiny TNC-2 is about half the size of the original TNC-2, and comes fully assembled and tested.

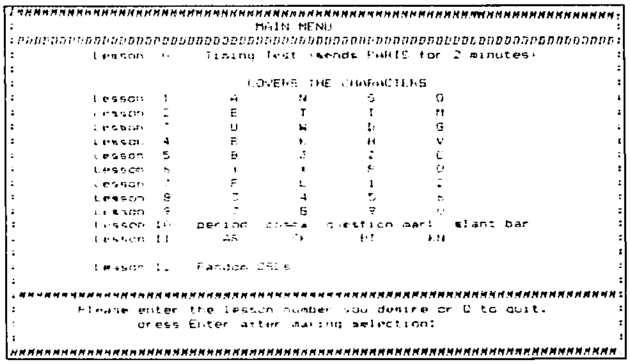
The Tiny TNC-2 retails for $120, plus tax and shipping. To order, call (800) 223-3511 (in Florida, (813) 874-2980). For additional information, the address is: Pac-Comm Radio Systems, Inc., 3652 W. Cypress Street, Tampa FL 33607, (813) 874-2980, or circle Reader Service number 204.



AVCOM

AVCOM of Virginia, Inc., recently developed the SCPC-2000E Single Channel Per Carrier Receiver to receive FM SCPC signals from satellites operating in the 3.7–4.2 GHz band. The SCPC-2000E is capable of tuning up to 4 specific crystal-controlled channels from a transponder, and adapting to variety of de-emphasis requirements. A sophisticated phase-locked cavity oscillator referenced to an oven warm crystal oscillator provides exceptional frequency stability. The SCPC-2000E allows very high audio or data signal-to-noise ratios.

The SCPC-2000E receiver comes with a 1-to-2 or 1-to-3 expander module, selectable lowpass 15, 7.5, and 5 kHz audio filters, on-board driver stage for low-impedance headphones, and wideband or narrowband models. The SCPC-2000E is rack-mountable and may be used with the AVCOM SS-1000 SCPC demodulator for simultaneous reception of additional channels. Suggested retail price is $1,875. For more information contact: Kevin Nolan, at AVCOM of Virginia Incorporated, 500 Southlake Blvd., Richmond VA 23236, (804) 794-2500, or circle Reader Service number 202.

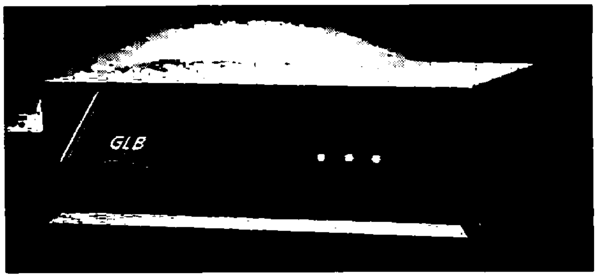


MORSE TUTOR

GGTE announces Morse Tutor©, Version 2.1, It teaches the International Morse Code, and improves the skills of those already familiar with the code.

Morse Tutor is available for IBM PC, XT, AT and equivalents. The program features both the Standard Method (words and characters at same speed) and the Farnsworth method (characters sent faster than the actual word rate). Morse Tutor also constructs and generates random QSO-type code practice. Users can calibrate the program for different PC clock speeds from the keyboard.

Morse Tutor sells for $19.95 plus $2 for shipping and handling (California residents please add $1.20 sales tax). To order, send check or money order to GGTE, 21881 Summer Circle, Dept. MTS, Huntington Beach CA 92646. Dealer inquiries are welcome. Circle Reader Service number 206 for more information.

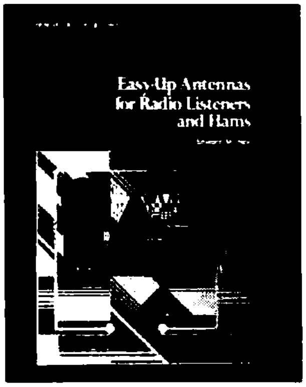


GLB ELECTRONICS

GLB Electronics announces a digital-in, digital-out data radio designed for high-speed packet linking. The Netlink 220 High-Speed Data Transceiver features 220–225 MHz simplex operation, 2 watts of output, and a data rate of 19.2 KB. The design was optimized for digital data transmission, providing a superior alternative to the adaptation of voice equipment. One can adapt it to use with any Node Controller capable of generating and accepting 5-volt CMOS logic levels, such as the TNC-2A.

The Netlink uses FSK modulation, requiring a 25-kHz receiver bandwidth at 19.2 KB. Its operational temperature range is −30 to +60 degrees C, making it suitable for use at sites having uncontrolled ambient temperatures. It meets Part 97 specifications.

The list price is $799, $699 Amateur net. For further information, contact GLB Electronics, Inc., 151 Commerce Pkwy, Buffalo NY 14224, (716) 675-6740, or circle Reader Service number 208.

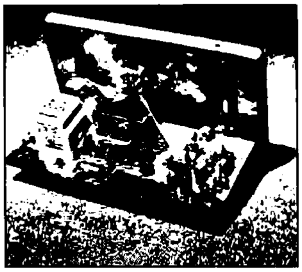


EASY-UP ANTENNA BOOK

Easy-Up Antenna for Radio Listeners and Hams is a practical antenna book for radio amateurs and prospective radio amateurs, as well as for shortwave broadcast, FM broadcast, medium wave broadcast, LW, utility and scanner radio listeners. All of the basic and some of the more advanced antennas are covered. The antennas in it are easy to construct, erect, and put into operation.

The handbook is in two parts. The first is for radio listeners, the second for hams. Information in both parts, however, that is valuable to both hams and listeners.

This 157-page book sells for $16.95 plus $2 P+H. For further information contact: Edward M. Noll W3FQJ, Box 75 Chalfont PA 18914, or circle Reader Service number 205.



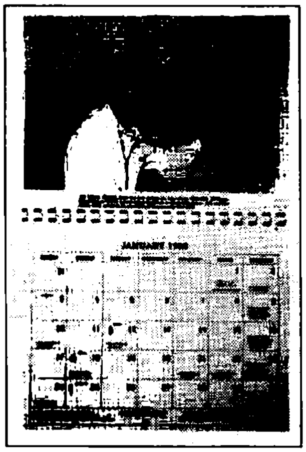
AMPIRE INC

Ampire, Inc., offers a mast-mounted preamplifier with a helical filter installed in the preamp itself. This GaAsFET preamp is RF-switch-able, and is voltage-regulated and RF-surge protected. The three models of preamps available are the 146, 1460S, and 440.

The 146 and 1460S have a noise figure of 0.92 dB and 19-dB gain. Model 146 covers the entire 2-meter band. Model 1460S has a 3-dB bandpass of 600 kHz, and is also factory-tunable for a specific frequency at customer's request. Both models handle up to 160 watts.

Model 440 is factory tunable at 430–440 MHz or 440–450 MHz. It has 0.75-dB noise figure, 15-dB gain, and handles up to 100 watts.

Models 146 and 1460S are $179, and Model 440 is $189. For further information call (612) 425-7709, write Ampire Inc., 10240 Nathan Lane, Maple Grove MN 55369, or circle Reader Service number 207.



KB1T RADIO SPECIALTIES

The 1988 edition of KB1T's attractive Amateur Radio Calendar is a must for every shack. Keep up with amateur radio contests, major gatherings, and important historical dates throughout the year. The calendar also features a handy generic contest logging form, ITU and CQ zone maps, a North American grid locator map, and much more.

The photos for each month attempt to cover the range of activities of the hobby. The topics are contesting, DXpeditioning, QRP, Field Day, Novice, and antennas. This year's calendar includes some history of radio. Two photos show the original site of Marconi's "wireless cable" commercial radio communications station, the first to establish transatlantic message traffic, starting in 1903.

In the US, Canada and Mexico, the 1988 Amateur Radio Calendar comes, first-class postage paid, for $9.95. Overseas, the price is $12. Ordering two or more calendars sent to the same address reduces the prices to $8.90 and $11 (overseas) each. For more information, contact: KB1T Radio Specialties, Box 1015-Y, Amherst NH 03031, or circle Reader Service number 209.

PK-FAX Program

PK-FAX Program allows display and transmission of Facsimile using PCs and compatibles. See page 38 for PK-Fax Program Review.

PART III OF A FOUR PART SERIES

BY DR. WILLIAM HESS W6CK

Number 17 on your Feedback card

DRIFTING ALONG THE TELEGRAPH TRAIL

Memoirs of a Former Telegrapher

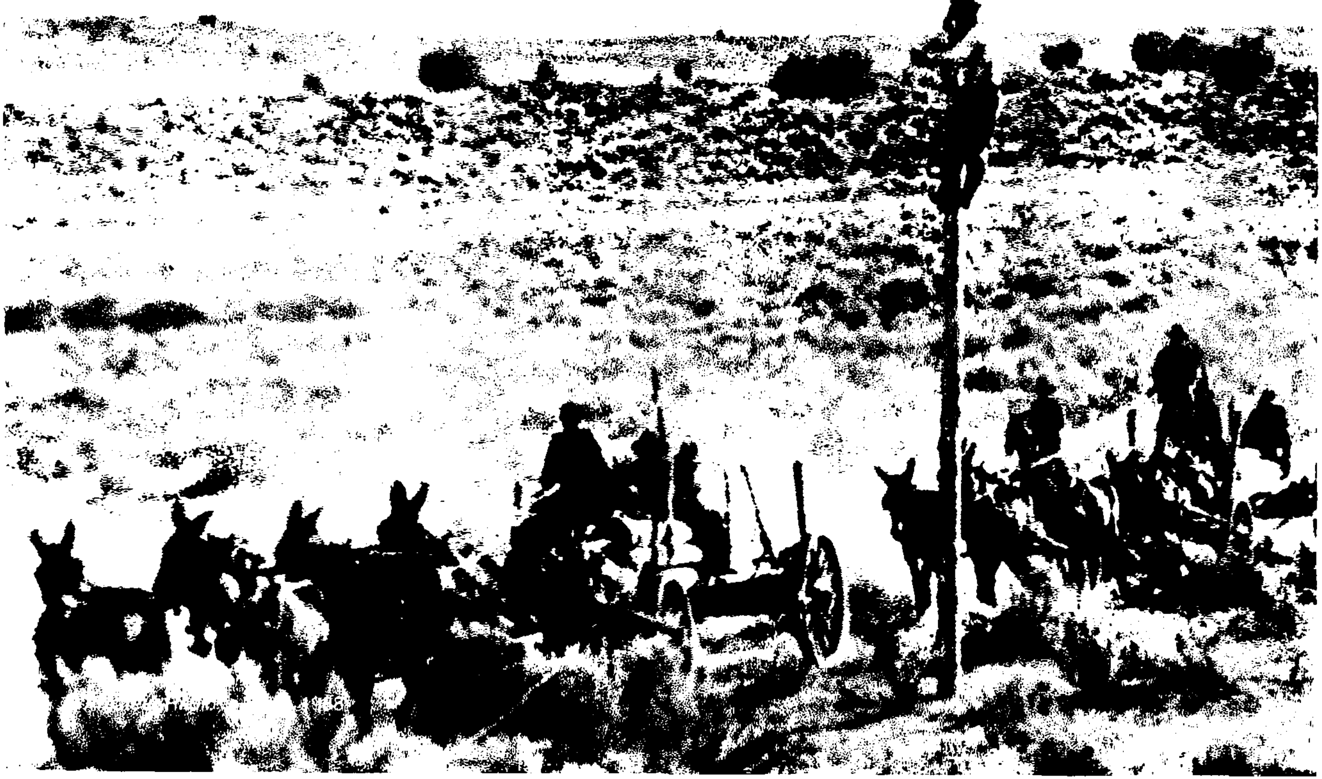
Many are the tales told about "boomer" telegraphers, the legendary characters who travelled extensively throughout the United States and Canada during the years that telegraphy was the only means of communication.

My wife, a registered nurse, could currently arrive in any city and be employed within an hour at a hospital because of the great demand today for trained nurses. The same situation existed with telegraphers years ago—their services were in great demand, and employment anywhere was never a problem. There were five hundred full-time telegraphers employed in the city of Atlanta at one time.

The Transient Life

This plethora of employment opportunities was one reason the boomer telegrapher often walked off the job without even a day's notice—at times he even quit work in the middle of a shift. So when the boomers working for railroads in North Dakota felt the approaching winter, they would be on their way via freight train to Florida where the breezes were soft and warm, and where they could steal oranges off the trees for breakfast.

The station agent at Death Valley Junction on the Tonopah and Tidewater Railroad, after giving his son six months of instruction in the American Morse code, felt that the young man was sufficiently expert in telegraphy to pound brass by the larger railroad with which the T and T connected. So, armed with a pass to Los Angeles, where the Chief



Dispatcher would examine him on his telegraphic abilities and knowledge of train orders, the young man boarded the T and T passenger train and rode it to the junction with the big railroad where he would have to wait a couple of hours for his westbound train. That he would pass the required examinations was a foregone conclusion, since his services were badly needed.

While waiting for his train, he fell into conversation with the boomer telegrapher on duty at the junction. The boomer wore leather puttees as protection against the numerous rattlesnakes in the area. As the conversation and a freight train closely approached, a faraway look appeared in the boomer's eyes.

"Hell, kid" the boomer said. "You don't have to go all the way into L.A. to hire out, you've got a job right here!" The boomer tossed the depot keys to the young man and, with the expertise born of years of practice, boarded the slowly moving train and was gone.

Thus, the Chief Dispatcher, in absentia, placed a new employee on his payroll without having even seen him.

Shake a Keg

I once worked with a boomer operator who, although he had been wandering around the U.S. and Canada for forty years as an itinerant telegrapher, had not seen fit to buy a suitcase. He said it would be foolish to spend good money for one when whiskey was so cheap.

In lieu of regular luggage, he had a nail keg. Matching holes had been drilled through the sides of the keg, near the top and corresponding holes were also in the wooden cover of the keg. A light rope had been threaded first through the sides of the keg and then brought out through the holes in the keg cover. The two ends then tied together. The rope, of course, was the carrying "handle" for this wooden "suitcase." The rather clever method of inserting it into the keg insured that the more weight put into the keg, the tighter its wooden cover would be seated into the top of the keg.

"the boomer telegrapher often walked off the job without even a day's notice—at times he even quit work in the middle of a shift."

Extra Cash

During the many years Morse telegraphy was in its hey-day, Western Union had what they termed "bonus" wires operating between the major cities of the United States. A diminutive man, less than five feet tall, worked one of the bonus wires at the "Woods" office of Western Union in Chicago. (This was the largest telegraph office in the world.) Every day, after he had received two hundred messages (called his "stint"), he would say to the telegrapher in New York City (with whom he worked seven days a week) "Let's skip 400 numbers." After their stints, each of these telegraphers would be paid a bonus of two cents a message for each message they sent or received during the remaining hours of their shift. Every message was numbered. Skipping 400 messages numbers at two cents per message meant that each of these operator would be paid an extra eight dollars for messages they had never actually handled. This procedure resulted in a big increase in their take-home pay, which was only normally about three dollars per day. A dollar a day insured the cooperation of the file clerk (who was supposed to audit the "bonus" message account), and the fraud continued unchecked for years.

However, the little man foolishly started to quarrel with the Chicago file clerk, with the result that she reported the cheating, conveniently failing to mention her own participation in the scheme for many years. The tiny telegrapher was, of course, immediately required to report to the office of his boss who threatened to "blackball" him so that he could never get another job telegraphing anywhere in the United States.

This was an idle threat, however. There were no Social Security numbers in those days or any other means of identifying individuals. The discharged telegrapher would merely adopt a new name and journey to another city where instant employment would be available to him because of the great demand for telegraphers.

However, the small man looked his boss squarely in the eyes and said, "Look, I have my own home paid for here in Chicago, and I have it fixed up just the way I want it. So I don't want to leave Chicago. But if you fire me and put some boomer in my postion, he will start skipping numbers the first day on the job, because he will have nothing to lose and doesn't give a damn whether he stays here one day or a year. He can get a job anywhere. If you keep me on the job, I promise by all that's holy, I will never skip another number as long as I live."

The boss digested this statement for a minute or two and said, "I guess you are right. Now go back to your position. I'll be checking on you, and don't let me ever catch you skipping numbers again!"

(The final part of this series will follow next month.)

The 4 + 1 Tone Decoder

Decoder for both group and individual calls for under $35!

by Andrew Mitz WA3LTJ

Hams often wish they could shut off all the signals on a busy repeater except the one calling specifically for them. It would be nice to leave the HT on at work without getting fired!

Now they can with the 4 + 1 Decoder. It's a smart speaker that plugs into a speaker jack and remains silent until someone activates it with a personal 4 digit DTMF (Touch-Tone[1]) sequence.

The circuit was inspired by the local RACES/ARES emergency group. All the members had 2 meter radios, but few were willing to keep them turned on during the day at the office or late at night at home. The solution was to design a circuit that would allow each member to have his own four digit sequence, and also respond to a single command to activate everyone at once.

The 4 + 1 Decoder responds at any time to either a four digit sequence, or one digit sent for three seconds, hence the name "4 + 1 Decoder." Everyone's decoder can be set to the same 3 second (long-tone) for a general call-up. Whether or not the call-up feature is used, each operator can still select a tone sequence up to four digits long for his own personal calling code. For under $35 in parts, it's hard to beat.

The idea of using a DTMF decoder to control a radio's speaker is not new, especially for emergency communications[2]. There's at least one high quality decoder with speaker available commercially for under $100 (Auto-Kall), and Heathkit offers a kit that can be readily adapted[3]. The 4 + 1 Decoder, however, is the first low-cost circuit that allows both individual and group calling.

Typical Operation

DTMF digits are selected with jumper wires in an IC socket. For low cost and simplicity, only digits 1 through 9 and special digit, "D", are decoded. The digits 0, *, #, A, B, and C are not recognized. One digit is selected for the single long tone, and one to four digits are selected for the sequence. A single digit can be used repeatedly.

The only other adjustment is a potentiometer. This is used to preset how many seconds the speaker will be on, once the proper digit is recognized. The decoder is then connected to the radio as an external speaker. The decoder's speaker remains off until it receives the proper digit or sequence. Once triggered, a "call" lamp lights and the speaker is connected to the radio's audio. After the preset period, the speaker is shut off until another valid input reactivates the speaker. There is a bypass switch to defeat the decode function and thus allow the user to listen to all traffic on the frequency. There is also a reset button on the decoder that immediately quiets the speaker and extinguishes the call lamp.

Circuit

Figure 1 is a schematic of the decoder board. U1 is a DTMF decoder chip. It does 90% of the work by recognizing DTMF digits and converting them into binary codes. Since U1 uses a "colorburst" crystal and sophisticated digital filtering, its accuracy and stability are superior to decoders made from phase-lock loop tone decoder ICs (e.g., the LM567)[4]. U2 converts the binary codes from U1 into individual signals, one for each digit 1 to 9, and digit D.

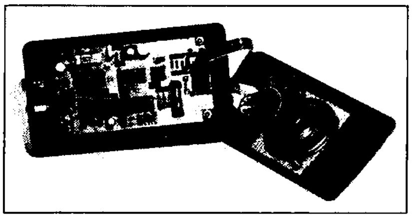


Photo A. Inside view of the completed decoder. The circuit board is on the bottom of the box. A ribbon cable connects the board to the speaker, LED, and switches on the front panel. Jacks for audio input, external speaker output, and power are mounted on the far end of the box. A piezo buzzer (see Figure 2) was not included in this version.

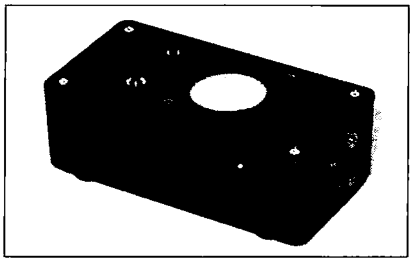


Photo B. The encased tone decoder.

Sequence Entry

The programming socket allows the user to pick off the digits and send them to U4 for either sequencing or timing. The sequencing method is unusual and is one reason for the low cost. The first digit of the sequence charges C5 via CR2. C5 will hold its charge at one of the two inputs to U4a for about half a second. During this period, the second digit can enable the other input to U4a. Once both inputs to U4a (an AND gate) are active, the output of U4a turns on and charges C6 via CR3. Now one input of U4b is enabled for half a second, while the circuit waits for the third digit in the sequence, to enable the other input to U4b. A successful third digit activates the output of U4b, which this time charges C7 through CR4. If the fourth digit arrives within the next half second, it similarly enable U4c's output. This output activates the call lamp latch (U5) and speaker timer (U6).

Long-tone Timer

The long-tone timer operates on a variation of the sequencer. While the long tone is received, R3 slowly charges C4. If the long tone stops before the three second interval, CR1 (which has the opposite polarity in the circuit as D2-D4) rapidly discharges C4. Once C4 is fully charged by a sufficiently long, uninterrupted digit, the output of U4d is enabled, which triggers U5 and U6.

A successful sequence or single three second DTMF digit starts timer U6 and latches U5. U5 holds the call lamp on. Meanwhile, while U6 is running, relay K1 is energized and connects the speaker to the radio's audio. The reset button resets U5. The reset button also interrupts the timing period of U6.

U4 is the regulator for a versatile power supply which will accept 7-14 volts, AC or DC. Two typical power sources are an automobile cigarette lighter and a modular wall transformer.

Changing Timing

The value of C4 determines the duration requirement for the long tone. Longer times require larger capacitance values. Three sec-

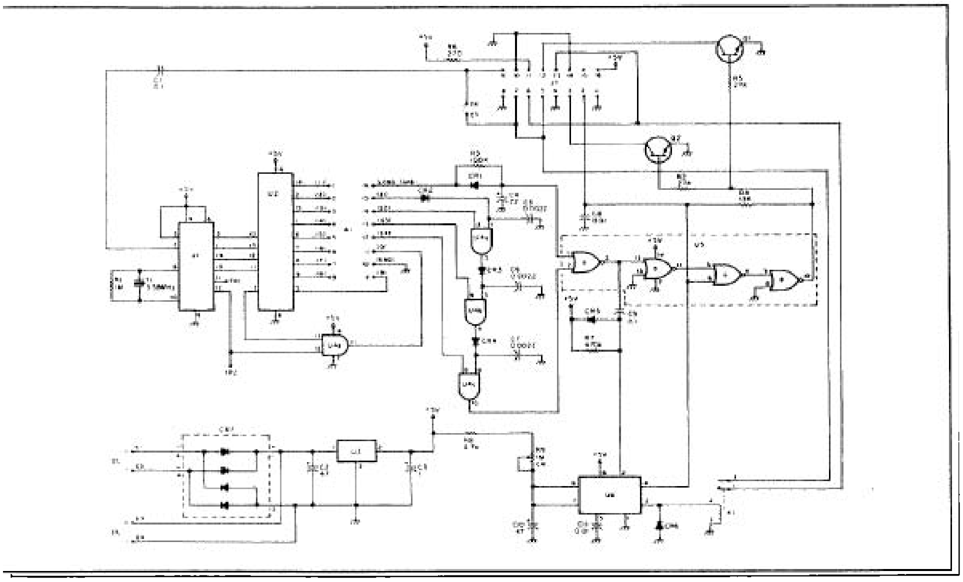


Figure 1. Schematic of decoder circuit.

Parts list:

Circuit board			
C1	0.1µF		
C2	47µF	16V electrolytic	
C3	1µF	6V electrolytic	
C4	22µF	16V electrolytic	
C5–C7	0.0022µF		
C8	0.01µF		
C9	0.1µF		
C10	47µF	6V electrolytic	
C11	0.01µF		
CR1–CR6	1N914 or similar		
CR7	DB101 or VM08 bridge rectifier, or 4 1N4001 diodes		
K1	Radio Shack 275-232 miniature 5-volt relay		
Q1,Q2	2N3904		
R1	1.0MΩ	¼W	10%
R2	27kΩ	¼W	10%
R3	100kΩ	¼W	10%
R4	15kΩ	¼W	10%
R5	27kΩ	¼W	10%
R6	270Ω	¼W	10%
R7	470kΩ	¼W	10%
R8	4.7kΩ	¼W	10%
R9	1MΩ	1-turn trimpot	
U1	RCA CDD22204E or SSI 204 DTMF receiver		
U2	CD4028B CMOS BCD decoder		
U3	78L05AC low power 5V regulator		
U4	CD4081B CMOS quad AND gate		
U5	CD4001B CMOS quad NOR gate		
U6	NE555 timer		
W1	16 pin IC socket and 16 pin header		
Y1	3.579545 Colorburst crystal		
External to circuit board			
Buzzer	Radio Shack miniature piezo buzzer		
Case	Radio Shack 270-223 (6″ x 3.15″ x 1.84″)		
LED	regular or flashing LED		
Power	8 vdc, 400 mA wall transformer (Jameco DC800)		
Speaker	4Ω or 8Ω miniature speaker		
Switches	SPST normally open momentary switch (reset)		
	SPST miniature toggle switch (buzzer disable)		
	DPST miniature toggle switch (decode/bypass)		

Except for U1 and K1, the parts for this project can be obtained from Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002. (415) 592-8097. U1 is available through RCA (CD22204E), 17731 Irvine Blvd. Suite 104, Magnolia Plaza Building, Tustin CA 92680. (714) 832-5302 or Silicon Systems (SSI 204), 14351 Myford Road, Tustin CA 92680, (714) 731-7110.

onds, however, proved most practical. The entry speed for sequential decoding is determined by C5–C7. Larger values relax the speed requirement, but increases the possibilty of false triggering from digit sequences similar to the programmed sequence. For example, if the sequence of 6-8-2-1 is sent fast enough, it will trigger a decoder set for the sequence 6-2-1. If false triggers are a problem, decrease values for C5–C7. The speaker timer is controlled by R9 and C10. The values shown allow times ranging from 1 to 60 seconds. Increasing C10 increases this range. Ranges up to 10 minutes are possible.

Programming

Both the long-code and the 1 to 4 digit code sequence are programmed at the programming socket (W1). The easiest method for programming is to wire a 16-pin IC "header." Wire several headers for quick programming changing. Pins 1 through 9 of the header correspond to DTMF digits 1 through 9, pin 10 is ground, and pin 11 corresponds to the digit D. To program the long-tone, select a digit and tie a jumper from the corresponding pin number to pin 16. Jumping pin 16 to the ground, pin 10, disables the long-tone timer.

Sequence programming is almost as simple. Wire pin 15 to the first digit of the sequence, pin 14 to the second digit, pin 13 to the third digit, and pin 12 to the fourth digit. If only a 3, 2, or 1 digit sequence is desired, wire the unused sequence pins (12, 13, or 14) to the last digit of the code. For example, when programming the 2 digit sequence 1-2, pins 12, 13 and 14 are all connected to pin 2. Here's a 3-digit programming example.

Header wiring to program Long-tone 5 and sequence 2-7-2:

Long-tone	pin 16 to pin 5 (digit 5)
1st digit of sequence	pin 15 to pin 2 (digit 2)
2nd digit of sequence	pin 14 to pin 7 (digit 7)
3rd digit of sequence	pin 13 to pin 2 (digit 2)
4th digit of sequence	pin 12 to pin 2 (digit 2)

This example illustrates one important limitation to the sequence programming: The decoder can't differentiate between a single digit and a single digit repeated (e.g. 2 versus 2-2-2). For example, the program sequence 9-1-1 triggers the audio with 9-1

Power Consumption

The circuit draws 15 mA while waiting for a call, mostly due to U1. This makes operation from a small (9 volt) battery impractical, so I use a $15 motorcycle battery to power the decoder and HT at night. When the relay and LED are energized, the circuit draws slightly over 40 mA.

Construction

Component layout is not critical. Just remeber to keep the connections from U1 to the crystal fairly short, and carefully handle the U2, U4, and U5 CMOS ICs. Either wire-wrap or point-to-point wiring will suffice, but using a printed circuit board is easiest (see using a printed circuit board is easiest (see parts list). The available PC board will hold all the components except LED, speaker, connectors and switches. Most of the connections external to the board (Figure 2) are connected via holes for a 16-pin IC socket (J1). One can wire connections either directly to the board or through a header plugged into an IC socket.

I built the completed unit shown in Photo A into an inexpensive plastic box (see parts list). A hole saw, normally used to cut 1″ subminiature toggle (decode/bypass) switch holes or smaller, drilled a speaker hole into the removable lid of the box. A piece of perf board served as the speaker grille. When mounted in the box, the inexpensive 2-inch speaker had remarkably good audio quality. The call LED was mounted just above the speaker using a dab of epoxy to hold it in

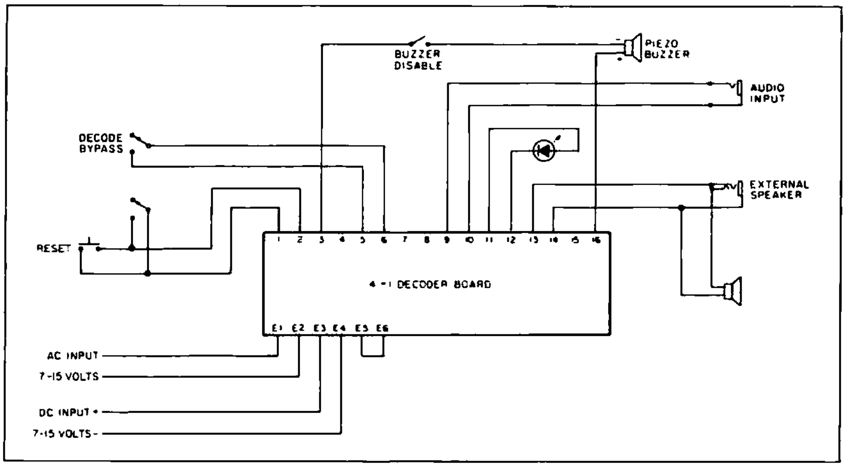


Figure 2. Wiring external to the circuit board. This configuration is for activating an internal or external speaker.

place. A push button reset switch and a DPST subminiature toggle (decode/bypass) switch are mounted below the speaker. The PC board sits on metal stand-offs bolted to the bottom of the box, but before the circuit board fit into place, connectors were mounted at one end of the box to accomodate audio input, external speaker, and power. I chose the external speaker jack to match the jack on my rig. (This way, I don't need an adapter to use my external speaker with either rig or decoder.) The audio input jack is a different size to prevent errors. A standard concentric-type power jack is the power connection. Ribbon cable connects the circuit board to the jacks, and the circuit board to the top panel. Stick-on rubber feet added to the bottom of the case puts on the finishing touch.

Configuration

The board operates from either AC or DC. Board connections E3 and E4 are for + and − connections, especially if a DC source is used. Omit rectifier CR7 in this case. There's a DC wall transformer in the parts list (obviously an AC transformer with built-in rectifiers) available for under $2. For those who already have an AC wall transformer from an old calculator battery charger, use either a bridge rectifier chip (DB101, VM08, etc.) or 4 individual power rectifiers (1N4001 or similar) for CR7. AC input goes to board connections E1 and E2.

One can use relay K1 to switch something other than the speaker. E5 and E6 are jumpered for speaker operation. Removing the jumper separates the relay from the audio input.

A latched output is useful to drive a buzzer or an open-collector driver for another logic circuit.

While most radios have sufficient audio to drive the decoder, there may be some applications where the decoder needs to accept a low audio level. Since the decoder's input impedance is much higher than the typical 8Ω output of most radios, an 8–1000Ω audio matching transformer makes the decoder more sensitive.

Testing and Operation

It's best to test the power supply before installing the ICs. Assuming the PC board is used, install U4, C1, C2, and optional, CR7. Apply power to the circuit and measure the voltage across C2. This voltage must be between 4.5 and 5.5 volts. Install the remaining components, being careful about the polarities of diodes CR1 through CR6.

Test the decoder by connecting it to the radio with which it will be used, and use a second radio (driving an RF dummy load, of course) to generate the tones. Those with an ICOM IC-2AT or similar radio can connect the decoder to the earphone jack and the antenna connector to a dummy load. These HTs produce the DTMF tones in the speaker circuit at the same time they are transmitted. Connect a voltmeter to TP2 on the board. Without any incoming tones, the reading should be under half a volt. Turn down the audio to the decoder and transmit any DTMF digit. Slowly increase the volume. At some point, the voltmeter should jump up to around 4.5 or 5 volts. This volume is the minimum necessary to trip the decoder. Try increasing the volume and see if there is a point where the voltmeter drops back below 2 volts. This is the upper limit. Set the volume control somewhere between the two limits and move the voltmeter to pin 1 of the programming socket. Hit "1" on the DTMF keypad. When the digit is pressed, the voltage at pin 1 should go from under half a volt to over 4.5 volts. Check pin 2 by sending a 2, and so on through pin 9. If the rig has the 16 digit keypad, check pin 11 while holding down digit D.

Overall Operation Test

Program the header for a long-tone and a 4 digit sequence, and set potentiometer R9 to approximately its midpoint. Try the sequence or long-tone. If the call lamp lights but the speaker fails to activate, check the connections of U6 and K1. If the call lamp fails to light altogether, check the header programming, the wiring of U5 and the polarity of CR1 through CR6.

Conclusions

The 4 + 1 Decoder is a versatile circuit that allows the user peace and quiet without the threat of missing a personal call or emergency callup. It's ideal for the office or wherever hearing conversations on a busy channel are not appreciated.

References

1. Touch-Tone is a Bell trademark. For background on DTMF encoding and decoding see: Nassar, Dale: "DTMF Encoding and Decoding," *Radio-Electronics*, December 1986, p. 65.

2. Paquette: "A Time Delayed Tone Decoder," *QST*, February 1977, p 16.

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Kumetz, Ronald P. Jr. N2ENW: "The DTMF-64 2 Decoder," *QEX*, Apr 1987, p 4.

Tanner, T. Ced VE3BBI: "The Miniaturized, Simplified London Tone Alert," *QST*, Feb 1987, p 30.

3. Model HD-1530 Touch-Tone Decoder, Heathkit Electronics, Benton Harbor MI. Auto-Kall AK-10, Motron Electronics, 695 W. 21st Ave., Eugene OR 97405.

4. Time-DTMF Emergency Decoder Kit (#LJM2RK, also called STORM-ALERT), Metheny Corporation, 204 Sunrise Drive, Madison IN 47250.

5. PC boards are available from Midland Technologies, 34374 East Frontage Road, Bozeman MT 59715, tel 406-586-1190.

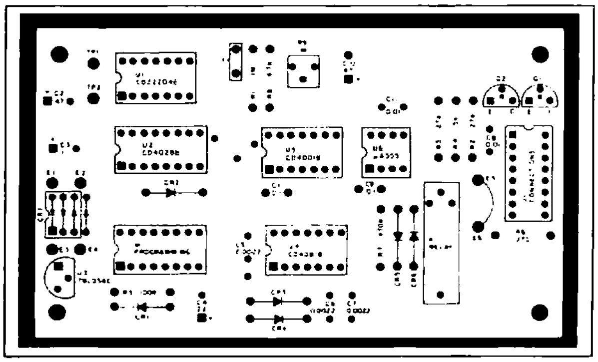


Figure 3. Parts placement on the circuit board for the 4 + 1 Decoder.

ATV

Ham Television

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

Interfacing Packet Radio to ATV

The BRATS ATV Group in Iowa was the first known group to integrate packet radio and SSTV modes into a Fast Scan TV Repeater. The idea and application is unique and not all that complicated. Ten folks of the 40-member group went packet and six got into SSTV because of this feature.

Packet

The Commodore 64 is the computer for this system. It uses a direct color composite video feed output that goes to a channel input to the ATV/R transmitter. The AEA PK-64 is the system TNC. It provides large 40-column text lettering, which is easier to read on ATV. The system also doubles as a vital, wide-coverage, 24-hour packet station digipeater (WB0BIZ-1) on 145.01 MHz, all housed at the Davenport, Iowa, KWQC-TV (NBC) Studio. BRATS plans to expand this system with a Kantronics KPC-4 Dual-Port system to connect VHF to HF.

Since the data-controller TNC system is multi-mode, the ATV Club can choose to monitor packet, Morse, RTTY, ASCII or AMTOR. They place the system on CW occasionally to let listeners practice Morse code over two meters (144.340 MHz FM) and watch the characters display back on UHF-ATV.

The unique aspect of interfacing a packet radio system to a FSTV/R is the ability to see what the TNC digipeater hears and sees. Monitoring such a system via ATV lets the group keep in touch with the operating status of the TNC. A quick look on ATV, verifies the system's condition.

Slow-Scan TV "Repeater"

The BRATS Group had on loan at one time a ROBOT 1200C Color SSTV Converter interfaced to their N9CAI ATV/R system. BRATS hopes to permanently install such a unit to add the excitement of a color display and automatic frame rate display. A black-and-white, 16-shade gray level, 8.5 sec/picture, ROBOT 400 SSTV converter is now interfaced into the ATV system. A few years ago, these converters sold for $795. ATVers can find these converters now at hamfests for around $100! The units present a good resolution picture that displays very well on FSTV.

Audio from VHF (144.340 MHz FM) feeds into the ROBOT 400 with the composite video monitor feed jack tapped to provide the TV output. The unit is left in the AC power ON position with a system switcher activated upon touch-tone user call-up. Members send taped or real-time SSTV signals over VHF and watch them repeated (cross-band and cross-mode) on ATV! Some system users pipe in SSTV signals off of the HF bands, such as those from the Saturday afternoon W1JKF/W9NTP net at 14.230 MHz. All of UHF ATV-dom can enjoy the show without investing one dime in SSTV!

One time a few years ago, our group placed the on-line ROBOT 1200C into automatic picture-camera snatch mode at 72 seconds. One of us fed processed video into the camera input jack from the ATV/R receiver output. Stations on UHF would put their best pictures on at 439.25 MHz, hold for a minute or so to allow the 1200C to capture the locked frame, then unkey on UHF and look at what they sent!

Bob W7KPW of the Central Texas ATV Group. He's at the 1450' level of a remotely-located W7KPW ATV/R Repeater system pointed toward Austin, Texas.

Dayton Draws Near!

The 1988 USATVS/Spec-Com Journal ATV Workshop sessions are shaping up with some great guest speakers. This group will meet again this year at the Ramada Inn North (I-70 & I-75) in Suite 212. Ride one of the shuttle buses over from the Hamvention on Friday or Saturday to attend.

The room will open at 5 PM Friday night with the programs beginning at 7 PM. Bill Brown WB8ELK from the Findlay, Ohio, ATV Group is one of the slated guest speakers. He will discuss his group successful launching and operation of last summer's helium-filled balloon carrying two meters and UHF ATV. John Beanland G3BVU of Spectrum International will talk about how to use bandpass filters to get rid of QRM.

Saturday's session opens at 3 PM, and the evening programs begin promptly at 7 PM. Two reps from the BATC ATV Club in England will speak on the state of Ham TV in Europe. Tom O'Hara W6ORG has another good line up for ATV forum meeting this afternoon. This columnist will give a short presentation on how to bedeck with bells and whistles an ATV repeater system. The smallish suite room holds 30–40 sitting people, and has standing room for a few more.

I'll be at the in-room bar keeping all refreshed, as last year. There is a $1/session door admission to help pay for the $100/night room. Come early to get a good comfy seat and—please—leave your cancer sticks in the car. Talk-in at Dayton for ATVers is on 147.450 MHz simplex FM (the ATV sound channel input) or 144.340 MHz FM. With luck, there will be a working station in the room monitoring the Dayton ATV/R system.

Don Miller W9NTP will hold his annual SSTV get-together at the Holiday Inn North, not far from the Ramada. Fred Sharp W8ASF of Timekit will team up with John at the Spectrum International booth in the main arena. The weather facsimile folks will meet on Sunday morning.

VCR Library

After nearly a year-long absence, the "A5 Videotape Library" is back in full swing to USATVS members! A new catalog list is out and available to USATVS Members for only a SASE. Tapes include FCC lectures, ATV demos, hamfest shows and forums, NASA space films, ARRL releases, overseas TV video exchanges, FSTV DX tapes, "R"-rated TV bloopers, and club system presentations. USATVS Members may borrow or obtain duplicate copies of established programs for a slight fee.

New Book Reprints

Ralph Wilson WB0ESF of ESF Copy Services 4011 Clearview Lane, Cedar Falls, Iowa 50613 has a few new "A5/Spec-Com Reprint Booklets" on the market. Booklet #100 are copies of the "sold out" *Everthing You Always Wanted to Know About ATV But Were Afraid to Ask* manual. Booklet #101 is a new release full of information about building ATV repeaters. Booklet #108 is on packet radio. He has several other booklets, all 100 pages or more in content on RTTY, satellites and TVRO, facsimile, SSTV, computers, UHF antennas, and construction projects. The booklets are well worth the money at $10 each. Include an extra dollar for return postage. Also look for them on sale at Dayton at the ATV Workshop sessions.

Frequency QRM Letter

Finally, a word about the frequency coordination problem violations against ATVers. The USATVS drafted up a 3-page letter with several addenda information sheets, charts, and tables about ATV Interference. This letter went to nearly all ARRL-recognized Frequency Coordinators, some ARRL and FCC Officials, and key USATVS committee members. Copies are available for a double-stamped SASE. This type of thing should have been done years ago, to avoid a lot of unnecessary misunderstanding and problems.

Hopefully, a better understanding and alertness of ATV groups around the country will at least temper the ignorant and prejudiced manner in which some FCs are acting. Register those ATV/R systems! Refer area FCs to this letter on any future problems or QRM correspondence. 73s de WB0QCD.

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

With spring comes hamfests. For the home-brewer, hamfests are the largest single supply of parts. Almost 80% of the components in my home-brews come from hamfests!

With the exception of some Radio Shack parts and parts from mail-order suppliers, the components in my shack come from the different hamfests that I attend each year.

Dayton!

The Dayton Hamvention, which again will become a large meeting place for QRP operators, will be held on the last full weekend of April. Hamvention '88 will provide lots of eye-ball QSOs with other low-power enthusiasts. There will be a QRP forum held on Saturday. There will again be several guest speakers this year. I'll be there talking about home-brewing in the '80s. Last year it was standing room only, so come early to get a good seat!

The QRP banquet will also be held on Saturday night. Bob promises to find us an outstanding place for the QRP dinner this year.

Don't Delay

Time is running out for to reserve lodgings for the convention. Myron Koyle N8DHT furnishes the reservation procedure. Send the following to: The Reservations Chairman, Myron Koyle N8DHT, 1101 Miles Ave. SW. Canton, OH 44710:

- Name and call
- Address
- Telephone number
- Room nights wanted (Thursday, Friday, Saturday, Sunday)
- Check made out to the Belton Hotel for one night's lodging ($55).
- Three SASEs (Self-Addressed Stamped Envelopes)
- Roommate's name, call (if there is one), address and phone number.

Many will remember that Dayton adds a room tax. For now, however, just send in the basic daily rate.

Myron records the name(s) and deposit and forwards both to the hotel. The hotel then sends the confirmation to him. He then records the verification and sends it back to the guest in one of the SASEs. This method ensures that the guest and the hotel work with only one person, which minimizes the chances of a foul-up.

Those who already made reservations with the Belton and didn't go through Myron should check with him to make certain that their names are on his list. The hotel will use only Myron's list to hold rooms.

Only one of a pair of roommates needs to contact Myron and send in a deposit. Remember, however, that if the person who made the deposit cancels out and gets a refund, the hotel cancels the room reservation! Be sure to coordinate efforts and not miss out on the outstanding QRP happenings this year at Hamvention '88!

Military Surplus

This is a great source of parts. Not all military surplus weighs over a ton—a lot of it was made to be man-portable. Michael Tyler WA8YWO writes to tell about a rather unique military surplus radio, the AN/PRC-64. This

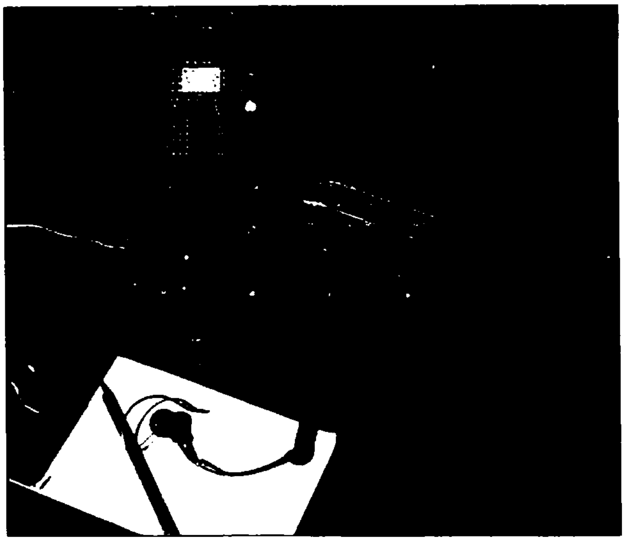


Photo A. The AN/PRC-64 right at home, in the field.

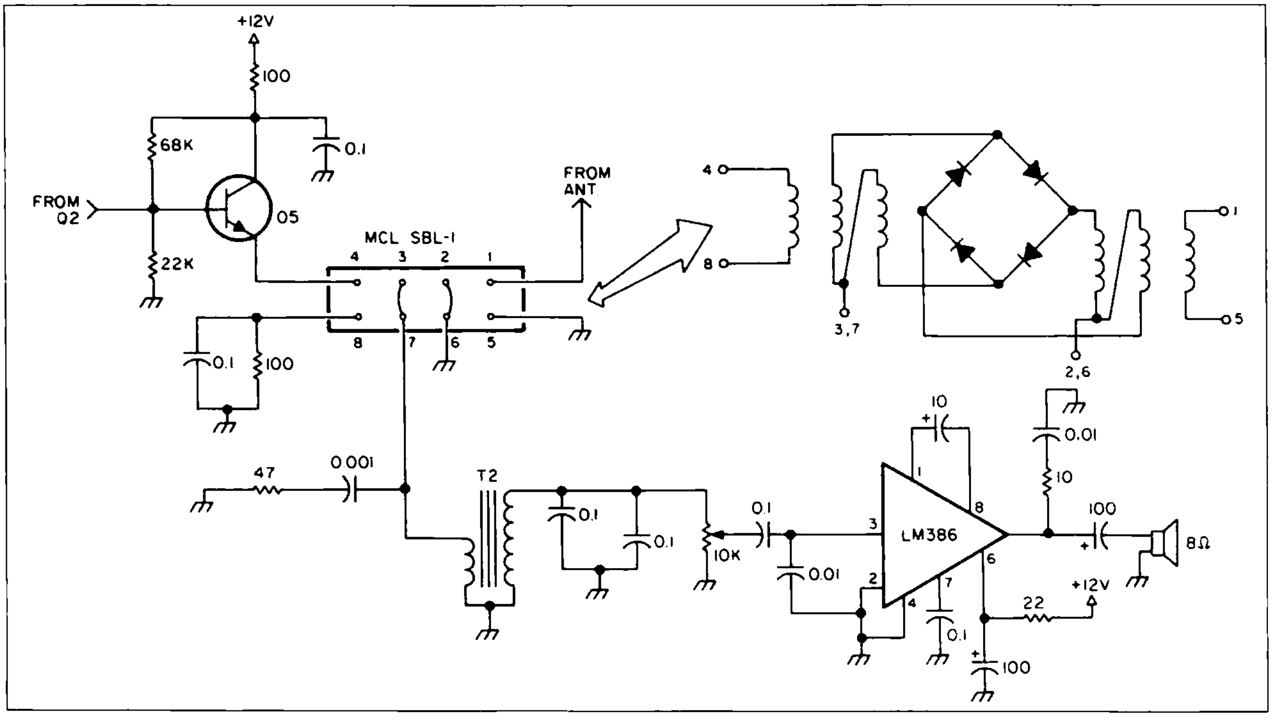


Figure 1. Original Two-Fer receiver schematic.

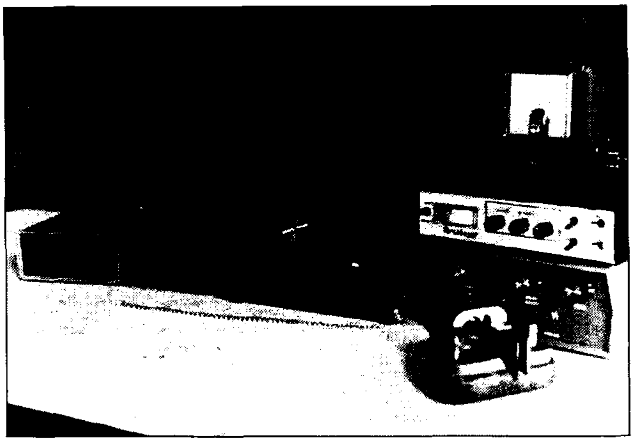


Photo B. All homebrew equipment from my shack. Most was built using hamfest parts.

Photo C. Why are all the people smiling? Could it be that I left the table to take this photograph? Or perhaps the good time all were having at the QRP dinner at the Dayton Hamvention. Left to right, Terry, N8ATZ, Dave, WD8AYE, Steve, N0CZV, and his wife Becky.

relates to the PRC-64, a military surplus transceiver. It has four crystal-controlled channels, five watts CW and 1.5 watts AM voice. The radio operates from 15 "AA" batteries. It is 5" X 4.5" X 10" and weighs in at only seven pounds with the batteries installed. The transceiver is also waterproof. This little rig will load into a dipole or a long-wire antenna thrown over a tree limb via the built-in antenna tuner. Tune up is very simple using the on-board peak indicator. The frequency range for this rig is 2–8 MHz, perfect for the 80 meter and 40 meter ham bands. Look through the Fair Radio Sales catalog, and keep an eye out at hamfests for an AN/PRC-64 (see Photo A).

Since the transceiver is crystal-controlled, you'll need a handful of rocks on your favorite frequency. Write to Jan crystals for their catalog.

Two-Fer Revisited

A lot of letters asked about the receiver section of the Two-Fer. I intended on waiting until John reworked the receiver, but the response from the Two-Fer prompted me to include the original receiver's schematic in this month's QRP column.

Oscillator energy (from the Two-Fer transmitter) is coupled to Q5, an emitter follower that provides +7 dBm to the mixer without loading the oscillator very much due to its high input impedance. The circuit is borrowed from the HW-8, which uses two of them.

The Circuit

The series capacitor/resistor to ground terminates at RF the output of the SBL-1 DBM. The audio is then applied to T2, a Radio Shack 1kΩ transformer. It steps up the audio voltage about 11 times and fairly well matches the 50Ω impedance of the DBM to the 10kΩ pot (volume control). The two 0.1μF capacitors across the secondary resonate it at 720 Hz giving about a 500 Hz bandwidth response and a nice clean waveform.

An LM383 amplifier chip is used for the audio section of the receiver. Don't forget to install the large capacitor from the 12-volt supply to the chip to keep the chip happy.

Last month I showed how to make trifilar toroids. Use that to homebrew a toroid if the SBL-1 can't be found. To wind the core, use ten trifilar-wound turns of #24 gauge wire wound on a FT-37-61 core. Use four matched 1N914 diodes. Use a VOM set on the ohms scale and check each diode for the same resistance. This is the way I match diodes for my mixer projects.

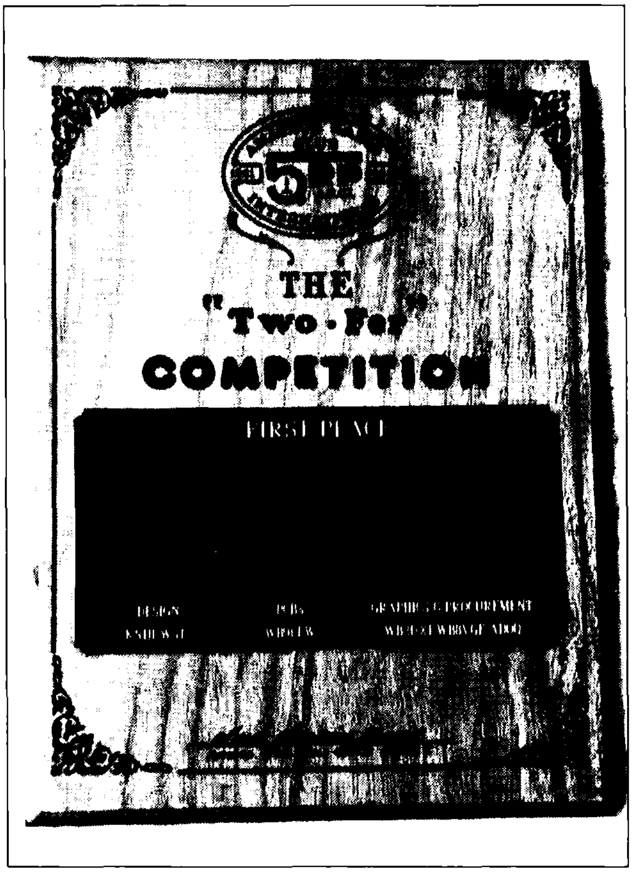


Photo D. Who will be the first to win the Two-Fer competition plaque?

Now it should be clear why the transmitter's oscillator runs all the time—the receiver requires it. Note that the receiver is based on the direct conversion scheme.

There are *no* PC boards for the receiver. Use either perf-board or the "ugly construction" method. Keep all the RF leads short. Use shielded cable from the Two-Fer transmitter to the receiver. Since there are no adjustments for the receiver, it should fly on power-up. Just remember that the transmitter section of the Two-Fer is needed for the receiver to work. The crystal oscillator supplies injection for both the transmitter and the receiver. Those handy with circuit switching can use a different source of RF for the mixer.

Since there is considerable interest in the Two-Fer, the QRP ARCI offers a rather attractive plaque. Winners have their names engraved on the brass plate on the front of the award.

Elmer SK

Glen Raudebaugh NR8Q, the one responsible for getting me involved in QRP, is now a silent key.

I recall going over to Glen's house and watching him work stations using only an HW-8 and some magnet wire thumb-tacked to the corner of his ceiling. Many a Field Day Glen and I worked QRP with a homebrew rig backing up the HW-8. Glen was very active within the Findlay Radio Club—he helped run the hamfest for several years and held office for the club.

Glen was only 35. Amateur radio lost an outstanding ham. I lost a close friend.

Number 21 on your Feedback card

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B
3335 Fieldstone Drive
Doylestown PA 18901

In Praise of 13cm

This month's column goes above, beyond and way out with a look at a nifty transverter kit for the 13 centimeter (2304 MHz) microwave band. It's the LMW Electronics 2304TRV1K, manufactured in England and imported for the USA by Down East Microwave of Troy, Maine.

LMW manufactures a variety of UHF products, including assembled transverter units for 903, 1296 and 2304 MHz, with power outputs in the 2–6 watt range. The options are endless, including outboard preamplifiers and internal sequencing boards. I elected to build up one of the kits (A) to save a few dollars and (B) to try my hand at some microwave construction.

Transverter Schematics

The heart of the LMW transverter is the Universal Local Oscillator board, or ULO (see Figure 1). This is a stable LO for microwave use that uses relatively few parts, is easy to fire up, and delivers plenty of output.

Both the 1296 and 2304 transverters use the ULO. For 1296 operation, the crystal frequency is 96 MHz, which multiplies 12 times to 1152 MHz (1152 + 144 = 1296). For 2304 operation, a 90.667 MHz crystal multiplies 12 times to give 1088 MHz. This is doubled to give 2176 MHz (2176 + 144 = 2304) on the transmit and RX mixer boards .

Figure 2 is the schematic of the RX mixer. T1, a 2N918 is used as the oscillator powered from an 8-volt regulator. T2 is a 2N5179 which works as a buffer/doubler stage and drives T3, a BFR91 tripler. Another BFR91 works as a doubler and the output is fed to yet another BFR91 Class-A amplifier. The outputs are derived from a 3 section filter at two points, providing both low and high level LO injection.

I bought the ULO, transmit mixer, receive mixer, IF amplifier and a chassis from Bill Olson of Down East during the Pack-Rats Hamarama in October 1987. Each individual board came in a ZipLoc bag with instructions, a schematic and several bags of parts.

Parts only Partly There

The first thing I did was to check the parts against the parts list and found a number of items missing from each board. For example, all five low-level amplifier stages and a mixing diode were missing from the TX mixer. Some capacitors and a mixing diode were missing from the RX mixer as well. On the other hand, the ULO kit contained two 2N5179 transistors instead of one which turned out to be a happy accident, as the 2N918 oscillator transistor simply would not work.

Bill said there were problems with kit packing in England, and he began packing the kits on this side of the Atlantic. The missing parts showed up promptly from Maine via First Class mail, and I set about to work.

Photo A. Top view of the ULO board. Note the crystal oscillator to the far left. TX/RX outputs lie on the right.

The ULO

This took little time to assemble. It shouldn't take more than about 2 hours to wire one and briefly test it. As mentioned earlier, not detecting output from the 2N918, I replaced it with the spare 2N5179, and the output shot right up! All stages are easily tunable with a diode probe and VTVM. One construction note: The interstage coupling capacitors after Q3 are extremely small and fragile chip capacitors, which cannot withstand much heat. The instructions suggested heating and tinning the PC board pad, allowing solder to flux over the ends to make a secure connection.

The pictorial diagram shows the approximate position of the trimmer capacitors for full output. Setting them as prescribed, with just a bit of tweaking, yielded just that. I connected each output to my Boonton 92 RF Millivoltmeter for the final alignment—not necessary but very helpful. The manual claims 40 mW at point "Y" and 10 mW at point "X", which seems like quite a bit of LO injection at first glance!

There is, however, a good reason for it. Both the TX and RX mixer boards double the LO frequency before injection. In the case of the RX mixer, that is accomplished by a pair of Hewlett-Packard HP2817 hot-carrier diodes–certainly not a scheme with lots of gain, but effective. The TX mixer board also uses two HP2835 diodes as a ring mixer, with an NEC 85637 transistor as the doubler.

I measured nearly 50 mW from the "Y" port and 12 mW from the "X" port, so the manufacturer's specifications were up to snuff. The output was also checked with a frequency counter and trimmed to 1080.00 MHz after sitting for 30 minutes. The display still sat on 1080.00 MHz 30 minutes later—very stable indeed.

RX Mixer, IF Amp

Photo B shows both these boards in the completed transverter case. LMW describes the RX board as a "Low Noise Preamp, Filter and Mixer" stage. The design is very simple (Figure 3). It uses just four active components: a Hewlett-Packard HXTR3645 bipolar transistor (T1), an NEC 85637 bipolar device (T2), and the two HP2817 diodes mentioned earlier.

T1 functions as a low-noise (2 dB NF) amplifier stage driving T2, which also has about a 2 dB noise figure. The 2300 MHz signal is then mixed in the interdigital filter with the doubled LO signal to provide output at 144 MHz, and not much output at that. Total conversion gain is only on the order of 8 dB with a 4-dB system noise figure, which is the reason for the IF amplifier stage.

This is nothing more than a 2-meter low-noise preamplifier using a BF981 MOSFET to develop nearly 20 dB gain with about a 1.5 dB noise figure. The total sys-

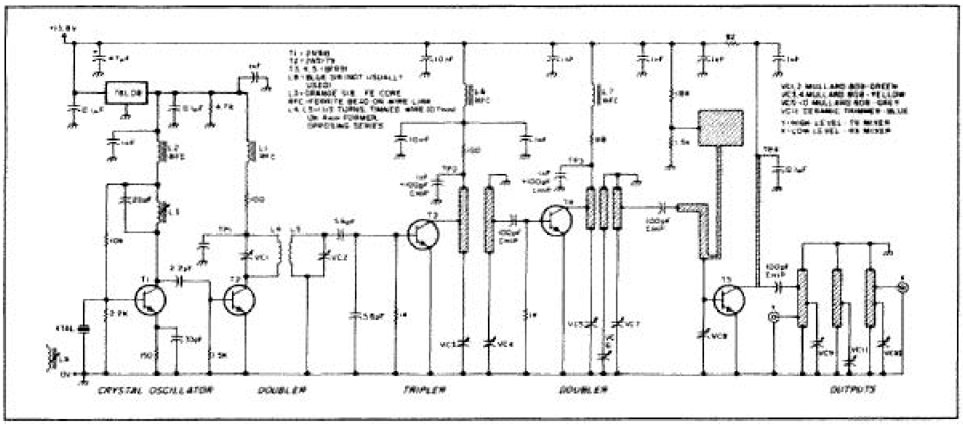


Figure 1. The Universal Local Oscillator schematic—the heart of the LMW transverter.

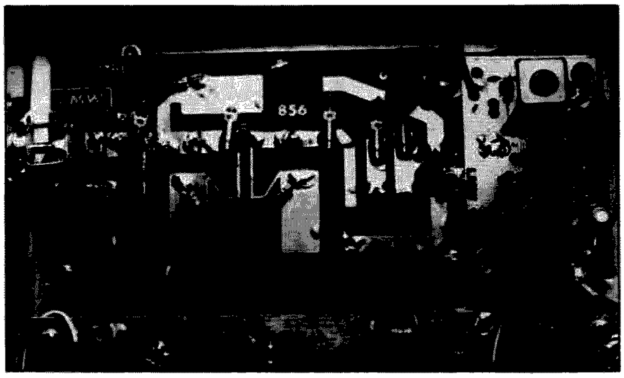


Photo B. 2320 PRE RX mixer (left) and 144P IF amplifier (far right) boards in the transverter case. The diode mixer/doubler is to the immediate right of the RX mixer.

tem conversion gain then works out to about 28 dB with a 5–6 dB noise figure. I found this level tolerable for 2304 weak-signal work.

Both boards go together in a snap! The bias networks and DC connections are soldered below the RX mixer board, strung in between the various feedthrough capacitors. (One note about these feedthroughs: the pre-drilled holes were too small and had to be enlarged with a hand drill. Be careful to not damage the etched inductors and tuned lines.)

The two transistors should be installed last, since they are extremely small and fragile. I tack-soldered one lead on each device to hold them into position on the board, then gently flux-soldered over the leads to minimize heat problems.

The IF amplifier board assembly is conventional, but one must take care to protect the gates against static electricity when installing the BF981. Unplug the soldering iron and make sure the board is grounded. Assembly time for both boards is two hours. The IF amplifier tunes up easily when using a signal source at 144 MHz and a receiver, since maximum gain is close to best noise figure.

The RX mixer board requires a signal source at 2304, which could be the 16th harmonic of 144 MHz. Dave Mascaro WA3JUF of the PackRats was nice enough to tune my RX board up with a microwave oscillator and spectrum analyzer probe, after which he determined the noise figure to be 4–5 dB, and the conversion gain to be 8 dB. These are close to the specs. Incidentally, LMW does make an outboard GaAsFET preamplifier using an NEC 72084 device for 2304 MHz. I strongly recommend purchasing it, as it yields about 10 dB gain with about a 1.5–2-dB NF, and makes a big difference in received signal strength.

To Be Continued...

The IF amplifier input may need retuning once it's connected to the output of the RX mixer board. The ULO input to the RX mixer will almost certainly need repeaking. When I initially tested the RX mixer on the air, I couldn't hear a peep from two nearby stations which should have been S-9 plus. A quick check with the Boonton 92 and counter showed insufficient injection of the 1088 MHz signal to the HP2817 diodes. Repeaking VC9–VC11 on the ULO board brought it up another 10 dB, which made all the difference as both stations were now S9 + 20dB! The GaAsFET preamp increased signal levels a bit more and also improved the signal to noise ratio.

At this point, I had a working local oscillator, preamp, mixer and IF amplifier for 2304 that was percolating nicely. Despite missing parts and somewhat hard-to-read pictorial diagrams, assembly was relatively painless. The next step was to build up the TX mixer board and this turned out to be quite a job in itself! We'll cover its assembly and the final on-air tests next month.

JANUARY VHF SWEEPSTAKES

This time I opted to stay off the mountains and out of the maternity wards to operate from the confines of my warm and cozy shack. Activity levels were excellent on all bands except 6 meters, which was a bit of a puzzle—after all, there were no football games to distract from or interfere with.

In my shack, an IC-740 drove a Microwave Modules MMT 50/28S linear transverter, with a Mirage A1015 running 125 watts to a 7-element KLM yagi at 35 feet. This is a real compromise 6 meter set-up, as soon explained.

The 2-meter lineup was the IC-740, MMT 144/28R, and a Mircowave Modules MML-200 amplifier running 150 watts to a Cushcraft 32-19 Boomer at 53 feet. The 220-MHz setup was the IC-375A feeding a Mirage C1012 running 120 watts to a Cushcraft 220 Boomer at 60 feet, and 432 activity was had with the IC-475A driving a Mirage D1010, developing 100 watts to a pair of Tonna 21-element yagis at 63 feet.

On 903, I used the SSB Electronics LT-33S to drive directly into a Down East Microwave 33-element loop yagi at 40 feet. An LT-23S was used on 1296 to feed an Adler cavity amplifier which pumped 80 watts to a 55-element Tonna at 65 feet. Finally, the LMW transverter ran a modest 300 milliwatts to a 45-element loop yagi at 40 feet. ARS KT2B was active on seven bands, six of which averaged 100 watts to single yagis in all but one case.

The Results

The final tally was 598 QSOs in 75 grid squares, including 11 QSOs on 2304. Some commonly-worked grids weren't logged this time, but a few surprises showed up on the bands and were quickly added to the log. Perhaps the biggest success was that no equipment failures occured, no water built up in the coax, and no rotors seized up!

UHF activity levels were excellent. I logged 90+ QSOs on 220, 110 on 432, and nearly 50 on 1296. Even 903 is quickly becoming popular—I bagged 22 stations in 6 grids. One can certainly make a lot of contacts with 150–200 watts on 2 meters during a contest. I bagged nearly 230, but probably could have increased that score substantially by running the 800-watt linear. When surrounded by stations running high power, it's hard to break through the QRM to a distant station, especially if it's near 144.200. The extra 6-dB can make all the difference!

Lastly, for those who haven't run the VHF Sweepstakes yet—why wait? I can't think of more stay-put fun to have during the cold January winter. There are more stations on during this contest than any other during the year, and it's a great "under the gun" way to evaluate your station. See you next year for the SS!

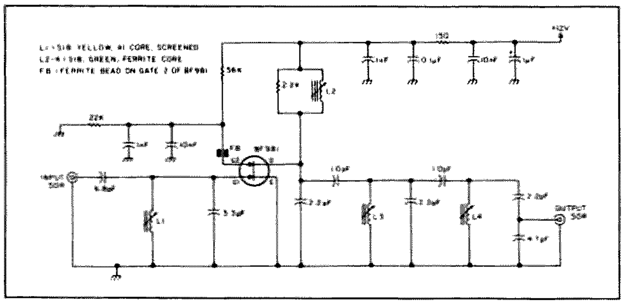


Figure 2. The RX mixer schematic.

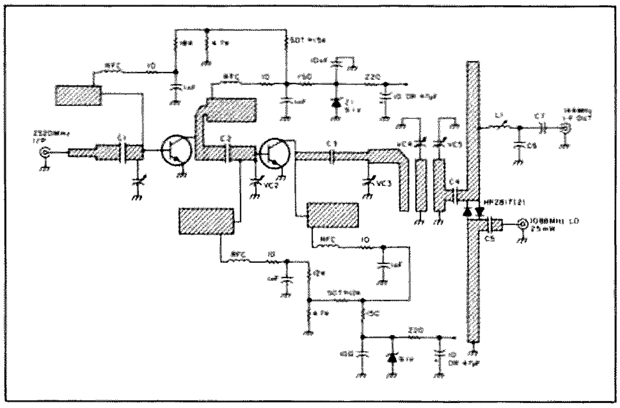


Figure 3. Schematic for the RX mixer circuit. It uses only four active components.

PACKET

Latest in Digital Hamming

Brian Lloyd WB6RQN
19200 Tilford Way
Germantown MD 20874

Packet in Emergency Communications

Ask almost any packeteer, and they are likely to tell you that packet radio is a natural mode for emergency and public service communications. Upon asking why, the answer may be, "It is error free," or, "Many people can share a channel." These responses, however, do not reflect an understanding of emergency communications needs. They're important, but they're not sufficient.

I have been involved in two large Simulated Emergency Tests (SETs) performed by the National Disaster Medical Service (NDMS). These events were very enlightening. The first test flopped monumentally as far as packet radio was concerned. Our group was able to pass only two or three pieces of traffic the entire day. There were several problems:

1. A critical digipeater failed.
2. Many of the operators didn't really know packet operations.
3. Many of the packet stations had not been tested beforehand.
4. There were no in-place procedures.
5. Connected-mode AX.25 did not facilitate the free flow of messages from one point to many points or from many outlying points to a single central collection point.

The second SET was a success for packet radio largely due to the efforts of Bob Bruninga WB4APR. Bob noticed that most of the messages were short and would fit into a single packet. Inspired by this observation, he wrote a program for the Commodore-64 that sends each message as an unconnected packet and receives acknowledgments the same way. In other words, this protocol sent each message as a "datagram" using the unconnected mode of the TNC. Bob also gathered together the equipment and operators ahead of time to ensure that the stations worked and that the operators knew how to use the software and equipment. Bob's successful experience with this SET later proved useful in moving a large amount of health-and-welfare information for a real emergency.

About a year ago there was a serious train wreck in Baltimore, Maryland, involving a large number of injured and significant loss of life. Again Bob Bruninga was on the scene. Bob had a complete battery-operated station in a briefcase, which he quickly put to work moving information into the W3IWI BBS. Tom Clark W3IWI removed the information locally and redistributed it via VHF and HF. All the traffic flowed efficiently and in a timely manner. Here, the connected mode of AX.25 was quite useful since, essentially, only two packet stations took part.

> **"(Bob WB4APR's) protocol sent each message as a "datagram" using the unconnected mode of the TNC."**

Looking at these cases more closely, note several common factors contributing to packet radio's success here:

1. Trained operators;
2. Pretested and preconfigured equipment; and
3. A knowledge of the type of communications so an appropriate mode can be selected.

Many hams often ignore the third element. Sometimes voice is the best way to move information; at other times the telephone. A ham isn't necessarily "cheating" by using the phone or removing his fingers from the keyboard and talking into a mike.

Hams tend to be communications specialists. Many understand both voice and data communications. Many are technically qualified and can use their knowledge and equipment to enhance communications when existing emergency communications are overloaded or broken down. It's usually more efficient to help shore up existing emergency communications than to offer a new and unfamiliar system to the responsible authorities.

The key to successful emergency and public service packet communications is careful planning and preparation. Make attempts to establish guidelines and procedures in conjunction with the local NTS, ARES, RACES, Civil Defense, Red Cross, City, County, State, and Federal emergency planners. Without this, it's VERY difficult to provide USEFUL service during an emergency. It's too late to begin at the time of the emergency.

The following few paragraphs are some ideas on improving emergency packet communications.

High-level Network Services

The packet community should take a great interest in Bob's unconnected datagram program for the C-64. It's a first attempt to tailor a system to disaster communications needs. It worked where a BBS would have failed miserably. Bob's success reveals the general need to define the required kinds of packet communications, and thus the software needed.

Fully-Automatic Mail System

This would deliver mail to the destination system and perhaps even print a copy of the message. This would be a godsend in an emergency situation. The operator need only tear off the message and hand it to the recipient. The originator addresses the mail to user destination. The networking protocol structure would release the operator from the need to know the message routing.

Automatic File Transfer Protocol

Like the mail service, this should be able to deliver any type of file—binary or ASCII—to the recipient without a great deal of operator intervention. Simply tell the system where to put the file and let it do the rest of the work.

Keyboard-to-Keyboard Mode

This would allow chatting or exchanging timely information.

All of these services should be able to run concurrently. The operator should be able to send mail, receive mail, send files, receive files, and carry on a QSO with several stations concurrently. It should be fully automatic so that the operator need only initiate the desired operation while the network does the rest of the work.

Since the data is digital, packet radio has the ability to move information other than ASCII text. Imagine the service offered by carrying a portable packet station to the site of a disaster, capturing an image of the damage, storing it inside the computer, and then finally transferring the digital image to the appropriate agency via packet radio. This is now possible!

Another area of interest is using digital voice messages. A fast packet network can move voice as well as other data. Current technology allows transmission of fully understandable voice data at 2400 bps, or telephone quality voice at 9600 bps.

How about facsimile? Most of the fax units manufactured today are digital units designed to move data over a telephone line using a modem. Why not pipe that data stream into the packet network to transfer the documents?

Packet radio has many possibilities for emergency, public service, and even just-for-fun use. Evaluate the need and then apply the appropriate technology. Don't try to replace HTs and repeaters with a packet station—the HT will win. On the other hand, there are many applications for packet where voice can't serve. Pursue those and let packet radio take its unique place in emergency and public service communications.

TCP/IP on Packet with net.exe

The previously promised review of the KA9Q TCP/IP networking code for the IBM-PC, Commodore Amiga, and Apple Macintosh, dovetails nicely with the "wish list" above.

The TCP/IP package written by Phil Karn KA9Q is a comprehensive implementation of the Internet Protocol Suite used commercially and by the Department of Defense for connecting different computers together using dif-

ferent and possibly incompatible underlying networks. TCP/IP is designed to run on top of other networks by inserting or encapsulating the TCP/IP packets inside the packets recognized by other networks (such as enclosing TCP/IP packets inside AX.25 packets). This technique of running a single simple standard protocol on top of other networking protocols is called internetworking. This led to the creation of the Internet Protocol (IP).

The KA9Q net package includes all the items mentioned in the wish list. A packeteer can do ASCII and binary file transfers, electronic mail, and keyboard-to-keyboard QSOs all at the same time with the same or different users.

The user needs an IBM-PC(lone), a Commodore Amiga, or an Apple Macintosh to run the KA9Q net code. The system TNC needs the KISS protocol (all TNCs from Kantronics and AEA have KISS built-in and KISS ROMs are available from TAPR for TNC-1s and TNC-2s). What follows is based on my experience with the PC version of the software, since my system uses a PClone.

Now for the software. The PC package is distributed on two or three diskettes, available from either Kantronics or TAPR. The three diskette set with the preconfigured disk is especially nice.

The files autoexec.net and bm.rc need some minor changes. These two files contain all the configuration information to allow the user to tailor the software to his station. This is the most difficult part of installing net.exe, but it is very clearly described in the documentation. The documentation has a tutorial that goes step-by-step through the configuration process.

Those with the two-disk set need to use the provided archive program to extract the files that make up the distribution, and place them on a floppy or the appropriate location on a hard disk. Once this is done, simply edit the configuration files and go from there. This is described quite clearly in the README file included on the disk.

Net.exe needs a network address to run. The only requirement is that this address be unique relative to all the other users. There is currently a plan to assign addresses on the basis of general location. Most parts of the world already have someone to assign addresses in a given area. Users who can't find someone to assign an address can check the documentation to find out whom to contact to get an address block for their area.

After getting the address, construct the routing table. This is how net.exe knows where to send its packets. Once done, ignore it until there is a major change in the network. Usually a packeteer needs to know his neighbors (those stations he can work directly) and his gateway (an IP packet switch). Any packets that have an address not belonging to a neighbor IP will route to the gateway. The gateways know how to route packets to other users outside the local area.

"I'm sold on the software... It's VERY simple to use and provides a level of service unavailable in any other packet program."

Once configured, run net with the net command. Net will start up and give you the following prompt:

net>

This means that net is waiting for input. To have a keyboard QSO with WB3ABC, use the command "telnet wb3abc" and net establishes the connection. The user need not enter any digipeater or other routing information. The routing table entries and those of the gateway take care of making the packets reach the destination. If WB3ABC is reachable, the operator is rewarded with the message "Established." Should he wish to establish another session with another station, he can press F10> and enter another command at the net> prompt.

To do a file transfer with WB6XYZ, he enters the command "ftp wb6xyz" and net again establishes the connection. When he gets the "Established" and the banner messages from the other station he logs in with the user command. Most stations use the user ID of "guest" for guests. After that, he will be prompted for the password. Here is an example (the operator's typing is indented):

net> ftp wb6rqn
SYN sent
Established
220 wb6rqn.ampr FTP version 871225.6 ready at Mon Feb 8 20:15:13 1988
user guest
331 Enter PASS command
pass wb6rqn
230 Logged in

He's now free to enter commands to the remote system. The dir command gets a list of files on the remote system, the cd command allows the user to change directories, the get command is for downloading files, and the put command is for uploading files. The type command allows for selection between image (binary) and ASCII file transfers. Image transfers do no conversion and the file is sent EXACTLY as it is. ASCII transfers translate characters from the standard used on the remote machine to the standard used on the packeteer's machine. This is useful only for text files.

The bm.exe program sends mail. The name comes from the name of the original author, Bdale Garbee, and stands for Bdale's mailer. Starting up bm tells about all arrived mail. The user chooses messages to read, respond to, or delete. He may also originate a message. If he responds to an existing message, bm automatically addresses it to the original sender and fills in the subject field. Nothing more is needed after processing the mail. Net checks for outgoing mail every five minutes (or any selected time period) and the mail is delivered automatically.

The user can also check into the local bulletin board or talk to a friend who does not have net.exe. He just uses the connect command as if net were a TNC. There is one small difference: he needs to specify the port to use, since net supports multiple TNCs and radios (this is how it can be used as a packet switch). An AX.25 connection command might look something like this:

connect tncA wb3ffv wb2sef

This means to use the port named tncA to connect to wb3ffv via wb2sef. Simple.

The biggest point of net.exe is that it allows concurrent operations (multitasking). It's fun and useful to set up one or more long file transfers then go read mail or have a QSO while the transfer is going on. There's essentially no limit to the number of things that can go on simultaneously. Net does a good job keeping sessions separate so that messages from one connection don't interfere with messages from another.

Some people are concerned about running an incompatible protocol, such as TCP/IP, on amateur radio. Rest assured, however, that all outgoing packets are pure AX.25. The only difference is that they contain the IP and TCP packets internally.

I'm sold on the software. It's my only packet program now since it communicates with NET/ROM, TEXNET, COSI, the local BBS, other TCP stations, and any other TNC. It's VERY simple to use after set-up, and provides a level of service unavailable in any other packet program.

The price is right, too. Phil has made it freely available to amateurs. TAPR and Kantronics charge a nominal fee to cover the costs of duplication and mailing. There's no better deal than that. Since PClones now cost about what a Commodore-64 system did a couple of years ago, more hams will likely be running this package. This software is a definite winner, especially in the area of emergency and public service events where the user just wants to send information and doesn't want to be bothered with the other details.

WEATHERSATS

View On Video Processing

Dr. Ralph E. Taggart WB8DQT
602 S. Jefferson
Mason MI 48854

Deadline Blues

Occasionally, *Weathersats* is missing from the pages of *73*. The first time this happened, I got anxious calls from people wanting to know why the column was canceled!

Not to worry. Every once in a while, there's a lot of graphics support for the column and it's not ready by deadline. This accounts for the lack of *Weathersats* in March. If the column is missing it won't do any good to berate the poor editorial staff—berate the columnist instead!

WB8DQT Station

This month is a run-through of my own installation along with a few comments on the evolutionary trends in the station to appear in upcoming columns.

Antennas

The primary WEFAX antenna is a four-foot (1.2 meter) Metsat GA-4 dish. The dish is spun aluminum. It has a weather-sealed O-ring feed assembly with a solid coax support that terminates in a Type-N connector at the rear of the dish. The antenna is mounted on a swing-arm assembly that mounts to the side of the house outside of a second floor window. (Read about the anatomy of this mount in the August 1987 Weathersat column.)

This antenna costs more than other options, but it's built like a tank. This unit has served continuously outside for almost ten years and is completely trouble-free. Considering all that can go wrong with a WEFAX receiving system, it's comforting to have one item to discount when trouble-shooting the system!

I also have a two-foot (0.6 meter) version of this antenna for portable work, such as providing weather coverage for soaring contests. This antenna shows a positive gain margin, but the pattern is too broad for regular use, which results in interference from adjacent satellites at some look angles!

Driving by the house, one may assume I don't have a VHF antenna system. The house, however, is an historic Victorian piece with a cavernous attic under all the steeply sloping roof gables—all the VHF antennas are in the attic! The antennas are completely out of the weather. Weather protection more than compensates for the incurred modest signal losses.

The primary VHF antenna is the omnidirectional "Zapper," described in *Weather Satellite Handbook* (*WSH*), with a Hamtronics GaAsFET preamp at the antenna. The feedline is RG-58 foam which makes the tortuous run down through the walls to the basement station location. The attic also contains the crossed yagi featured in *WSH*, complete with elevation and azimuth rotors. This antenna has a Vanguard JFET preamp and a feedline arrangement identical to the Zapper. The beam sits idle most of the time, however, since most polar orbit reception here is automatic, and the omnidirectional Zapper performs very well (see the picture of the month).

> *"An IBM PCjr runs the whole operation. It talks to the receiving/recording system through . . . a standard Centronics parallel-printer port."*

Receivers

The 1691-MHz receiving system starts with a Microwave Modules GaAsFET preamp mounted on the dish feed, driving about 20 feet of Belden 8214 to get the signal inside the house. A Microwave Modules downconverter takes the signal from there and converts it to 137.5 MHz for a long RG-58 cable run to the basement. John Beanland at Spectrum International in Concord, MA, sells both preamp and downconverter. John thoroughly checks out all units prior to shipment, because their performance on leaving the factory in Britain is not always up to his stringent standards. A Metsat GDC-4 converter receives a second satellite, and is used for portable work. VHF preamps are a must for long cable runs.

The primary receiver is a Vanguard unit equipped with crystals for 137.30, 137.40, 137.50, 137.62, and 137.85 MHz. This covers the operational U.S. TIROS/NOAA frequencies, 137.50 for the WEFAX IF and the most common Soviet frequencies. In addition to the standard manual switching, modifications permit the receiver to switch via TTL logic lines.

A Regency MX-5000 wide-range scanner is the search receiver to look for Soviet activity on non-standard frequencies. Its antenna system is a discone and a preamp, both located in the attic. This system isn't for imaging but just to spot new activity.

Automatic Operation

In the June '87 column, there are some simple but very effective approaches to unattended satellite reception. The one I use operationally is somewhat more complex but achieves great results.

Almost any computer that supports such a port could be used. I chose the PCjr because it has nothing better to do during the day, and generates little RF hash.

The parallel port configuration:
•(1) The 8-data lines are used for receiver channel selection.
•(2) One status line (input) looks at the 2400-Hz tone decoder output that is connected to the receiver audio output.
•(3) One control line (output) switches in the WEFAX downconverter.
•(4) One control line is used to switch power to cassette deck #1 while another control line does the same for cassette deck #2.

The computer has a real-time clock that provides constant access to date and time. The operating system is a simple BASIC program built around a customized version of the PREDICT program from *WSH*. The customizing primarily allows the system to keep track of both operational NOAA spacecraft. In addition, the program contains the complete GOES Central WEFAX schedule, less the charts.

The operating program is a balance of dealing with both knowns and unknowns. The "knowns" are the transmission times for any given WEFAX product, plus the AOS and LOS times (on any given day) for the NOAA spacecraft. The "unknowns" are times and frequencies for Soviet spacecraft passes. In operation, I select the specific WEFAX products of interest. For reasons to become evident next month, I usually specify the prime 1800Z quads for the full earth disc in both IR and visible light, but I can select anything from the complete schedule. Barring other imperatives, just prior to the effective time of a WEFAX quad, the system switches the receiver to 137.50 MHz and switches in the WEFAX converter. The computer then monitors the 2400-Hz tone decoder and starts the recorder if a tone is present. If the channel is inactive for 3 minutes after the scheduled transmission time, the system switches back to the VHF search mode. Otherwise, recording continues until the quad transmission finishes.

Except for scheduled WEFAX transmissions, the system works on VHF. Since it knows when to expect the NOAA spacecraft, it ignores 137.50 and 137.62 MHz except when it reaches the AOS time for a specific NOAA spacecraft. It then switches to the appropriate frequency and begins to monitor the tone detector.

Early in a pass, the spacecraft signal is noisy, marked by pulsing of the detector. The system doesn't begin taping until the detector has a solid lock for at least 15 seconds. Taping terminates anytime within 4 minutes of the calculated LOS time, when the tone detector again becomes erratic, indicating a noisy signal. This alone saves a tremendous amount of tape and makes review of tapes quite simple.

If there's no tone detector indication within three minutes of the predicted AOS time, the system switches to the secondary frequency, flipping back and forth for two more minutes in search of a subcarrier signal. It tapes whatever is found, otherwise the pass terminates and the system returns to the search mode. One may opt for AM, PM, both AM and PM, or lockout (no recording) for each of the two operational spacecraft, giving complete control over what is recorded.

The system sequentially scans all the primary Soviet frequencies most of the time. It looks for 2400-Hz subcarrier signals. Any signals

that meet the criteria noted under the NOAA discussion are taped, and the system keeps looking!

Three More OS Features

The first is that one can set priorities among the WEFAX, NOAA, and Soviet "modes." If the NOAA priority is set higher than the Soviet search mode, for example, the system breaks away from an active Soviet channel to record a NOAA pass. The system can also operate on a "first come, first served" basis.

Second, the system keeps a complete log on disk, noting active frequency, tape on and off times, and the date. This allows tape sequencing with no ambiguity. The final feature concerns the second tape deck. The decks are normally loaded with C-120 tapes, which record 60 minutes on a side. Once the system has recorded over 50 minutes of total time (the computer keeps track) on recorder #1, it makes all further recordings on recorder #2 with suitable notes on the disk log. In the unlikely event that both tapes fill to capacity, the system continues to log all active channel data to disk along with a notation that these were not taped! The tape capacity values (in minutes) can be changed to accommodate other cassette lengths. I do this routinely when going out of town, since I typically use a high capacity reel-to-reel system in such cases.

The bottom line? If it's a transmitting spacecraft, I can nail it on tape for later viewing. I hope to catch some 240 LPM Soviet COSMOS imagery!

Display

The heart of the display system is the *WSH* scan converter using the 512K Color Computer 3. This system's capabilities grow daily. Later columns will outline these enhancements.

The system can store a 768-line image (1024 pixels per line) and is compatible with any weather satellite image format, live or taped. In addition to gathering and displaying images on a standard monochrome TV monitor, the system has a growing number of output functions that support archiving of full resolution images. It can output as WEFAX any image in memory, regardless of the original format. Further, this requires less than 4 minutes of tape for storage with the added advantage of fully automatic display to review the archive tape. Full-resolution hardcopy is supported via Smartfax (see WEATHERSAT for September and October of 1987) or dumps to the Alden Weatherchart recorder. The full-resolution image can also dump to a much simplified CRT display, for photographic records. This is also the subject of a future column. I will also highlight some of the software features of the system next month, when I discuss some new tricks to perform on WEFAX imagery.

Picture of the Month

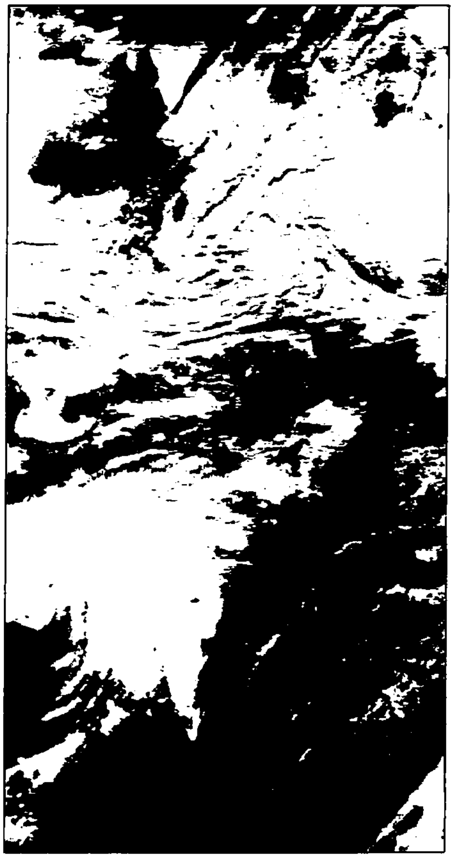
This rather elongated specimen represents approximately 10 minutes of a Soviet METEOR 2-15 pass over the Great Lakes In early December, 1987. The receiving system was the omnidirectional Zapper antenna on 137.85 MHz. The PCjr auto-tape system recorded this. The pass was ascending and image coverage to the south begins in the Caribbean just south of the Tropic of Cancer. The spacecraft passed across the U.S. and Canada, and the coverage ends at the southern end of Baffin Island, north of Hudson Bay, just short of the Arctic Circle! If you have any doubts about the effectiveness of omni antennas when teamed up with low-noise GAsFETs, this should set your mind at ease!

The scan converter can hold slightly over 6 minutes worth of 120 LPM imagery so the tape was displayed in two overlapping 768 line segments. The Smartfax printer printed each one from memory. The two prints, overlapped, makes the final composite of 10 minutes of image data. The scan converter permitted precision phasing and contrast adjustment, assuring the quality of the final FAX prints without wasting a single sheet of paper!

This print also illustrates the general utility of Soviet METEOR 2 imagery for winter viewing. Winter imagery from the U.S. TIROS/NOAA spacecraft is quite marginal here in the north country during the winter months. The daylight passes are early in the morning or late in the afternoon and sun angles are quite low. The visible light pictures are very difficult to "fix" in terms of display contrast, since one side of the image will be bright while the other side will be in deep shadow. This makes it difficult to achieve a single contrast setting across the entire image. IR data are all biased toward the cold (white) end of the dynamic range and are rarely useful without significant video processing. Thus, the TIROS/NOAA spacecraft, which do such a fine job in the summer months (or year round in the tropics), become marginal for easy use in the winter.

Here, the Soviet METEOR 2 spacecraft picks up the slack. This spacecraft series is notorious for the inability of the sensors to make distinctions between land and water features, so summer imagery is rather dull, consisting of beautiful clouds against a black background! The orbits are not sunsynchronous, however, so it is possible to get them passing overhead near midday during the winter, as was the case here. To the sunny south, the pictures look like typical METEOR 2 products but with the snow cover to the north you can get some simply fantastic ground detail that is a definite change of pace from murky TIROS/NOAA coverage.

Look for more samples in the coming months!



Picture of the Month. Image of the Great Lakes region by the Soviet METEOR 2-15 satellite. Winter imagery from the METEOR 2 spacecraft is often better than that from the TIROS/NOAA spacecraft for the northern U.S.

Reference

References to *WSH* refer to the Third Edition of the *Weather Satellite Handbook*, available from the columnist at $15.00 per copy. For orders outside of the U.S., please include an additional $1.00 for postage.

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
2310 Romayor Court
Pearland TX 77581

U-O-11 and the Polar Skitrek

While we wait patiently(?) for the launch of Phase 3C, another amateur satellite, UoSAT-OSCAR-11 provides a new public service. Its temporary mission is to relay navigational information to a group of skiers travelling across the North Pole from the Soviet Union to Canada.

73 Editor-in-Chief Larry Ledlow NA5E discussed the basics of the joint Canadian and Soviet Transpolar Skitrek in his January article "Look North!" He described mission objectives, the use of amateur radio for communications and the activities of several trek participants and support personnel.

Since Larry's article, there have been updates on the use of U-O-11 and some new expedition features. The amateur media received information from the following sources: the Polar Bridge Expedition, Inc. of Canada, *Komsomolskaya Pravda* (Soviet Youth Newspaper), The University of Surrey in England and AMSAT Science Education Advisor Dick Ensign N8IWJ.

About the Trek

The expedition began in early March and will last up to 100 days. The skiers will cross the North Pole from Cape Artichesky in the Soviet Union to Cape Columbia in northern Canada across 1700 kilometers of ice and snow.

In addition to being a challenging adventure coupled with the inherent political potential of a joint Canadian-Soviet activity (remember Apollo-Soyuz?), this walk across the top of the world has several scientific purposes. The trekkers will make geomagnetic, glacial and meteorological observations. They will test new materials and equipment. They will conduct experiments in physiology and biochemistry to test the limits of human endurance.

Four Canadians and several Russians are on the trek. The average age is 30, and two of the team members are doctors. They set out in the darkness of Arctic night during the coldest time of the year. Toward May they will be in constant light. This can become psychologically disorienting. For the last part of the trek, they will ski into the sun and the intense glare of its reflection from the ice.

The Arctic terrain won't allow a smooth and easy journey. Open water (rafts will be taken), thin ice, pressure ridges and low temperatures are just a few of the expected obstacles. The temperature will drop to −50 degrees Celsius. The wind-chill factor and the probability of storms will further hamper the skiers.

The trekkers will carry as much as 90 pounds of equipment in each backpack. Planes will drop supplies six times over the course of the trek. The first three flights are Russian, the last three Canadian. These planes will land only in an emergency.

On the Air

Project Nordski Comm (North Ski Communications) will provide the communications and navigation. Amateur radio is the main communications link to the skiers. They have a Russian-built, 10 watt, solid-state, crystal-controlled transceiver capable of operation at selected frequencies on the 20, 40 and 80 meter bands. Due to the limited life of their lithium batteries, the skiers will make only direct contacts with their support bases. The bases, however, are not working under the same power constraints. They encourage hams to contact any of the support operations during the period of the trek when not involved in mission-related activities.

The Canadian base station is located at Resolute Bay on Cornwallis Island. The ham station, special call CI8C, has been active since February. Operators of the station with VE8 callsigns can use the base callsign, or add the CI8 prefix while communicating from the base. Since there is a rotating crew of amateur operators, the station is active on the 20, 40 and 80 meter amateur bands many hours a day. Those who contact Resolute may QSL to PO Box 313, Don Mills, Ontario M3C-2S7, Canada. Other support stations will be on the air from Toronto and Ottawa. Modes of operation between support bases include CW, SSB, AMTOR and HF packet radio.

Listen for EKØKP on the Soviet side. This station is located on Sredny Island in the Severnaya Zemlya archipelago. Other support will be stationed at the Russian North Pole Station on Ice Island 28. Both Soviet and Canadian operators will operate from this mid-point base. Well known hamsat supporter and Chief Radio Operator Leonid Labutin UA3CR in Moscow and others in Dikson, USSR, will also be active.

"(The skitrek support bases) encourage hams to contact any of the support operations during the period of the trek when not involved in mission-related activities."

The navigation part of the Project Nordski Comm starts with small Emergency Locator Transmitters (ELTs) carried by the skiers. The SARSAT (Search And Rescue SATellite) and the Soviet counterpart COSPAS satellites, which hear the signals from the ELTs, relay location information to SARSAT/COSPAS processing ground stations. This information is then relayed to the University of Surrey in England.

At the UoSAT Control Center, the position of the ski trek participants is transmitted to the On-Board Computer (OBC) of U-O-11. The uplinked data is then used to program the digitalker experiment to provide a synthesized speech announcement of the expedition location. The satellite system has a 550-word vocabulary, including numbers.

The downlink frequency is 145.825 MHz FM. The skiers use a pair of ICOM IC-µ2AT HTs to monitor the satellite downlink. These radios have been tested for reliable operation at extremely low temperatures. ICOM America donated the HF communication equipment at the support bases and the skiers' HTs. Advanced Electronic Applications (AEA) provided packet radio equipment for the operation. Although the Skitrek team did not carry any packet gear, the support bases were provided with PK-232 packet/RTTY/AMTOR/WEFAX units.

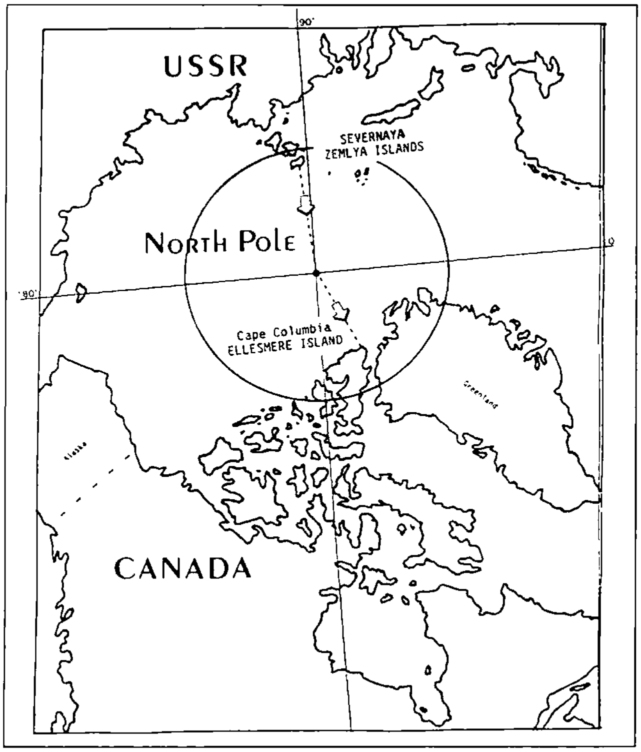
Listen In!

Since the skiers are at the North Pole, and U-O-11 is a polar-orbit satellite, they hear every pass. The satellite has a period of nearly 100 minutes, which corresponds to 14 orbits per day. For someone at 30 degrees North latitude (Houston, TX), about four to five orbits per day is typical. Monitor in the late evening hours between 7 and 11 PM and also in the morning from 9 AM until 1 PM local time. Any good HT can hear the beacon, but a good mobile rig or home station will make listening easier. Expect even better results from a beam antenna and tracking aids.

Since there is Doppler shift, monitor a few kilohertz above 145.825 MHz at the beginning of a pass. Shift the receiver lower as the satellite comes by, perhaps to 145.820 MHz as it reaches the end of the pass. A good pass will last between ten and 15 minutes.

Don't expect continuous digitalker. The University of Surrey has scheduled a mix of the usual 1200 baud data (Bell 202 compatible) and periods of digitalker operation. For every minute of voice, there are three minutes of digital telemetry. On Wednesdays (UTC) the schedule is somewhat different, but the digitalker is still heard less than the telemetry.

What can listeners do with the Skitrek positional data from U-O-11? Plot it on a map of the North Pole. In the Gulf Coast area, plotting hurricanes is a seasonal activity. Maps are even printed on grocery sacks in the worst



Polar Bridge Expedition map showing the route the skitrekkers will take. The skiers will receive supplies from six air drops, three each from both the USSR and Canada.

is something done in preparation for possible disaster, Skitrek is an opportunity to plot the progress of a challenging adventure through a region of the world few dare to travel.

The Educational Side

AMSAT NA (The Radio Amateur Satellite Corporation of North America) offers educators around the world information guides entitled "Exploring the High Arctic from Your Classroom." They provide this package through Dick Ensign N8IWJ.

The purpose of the guide is to allow teachers to share the Canadian/Russian Transpolar Skitrek via amateur radio with their students. Those pursuing the progress of the journey will encounter disciplines such as orbital mechanics, geography, arctic conditions (including ice-pack motion), and amateur radio. The package of materials includes tracking information for the location of the recipient with details on how to use the predictions effectively. They define terms and explain examples. They also include ideas for bulletin board sized maps and information on AMSAT tracking programs. Many other educational spin-offs are possible, and perhaps it will interest some young, potential hams. Educators may request this package from the AMSAT at P.O. Box 27, Washington, DC 20044.

AMSAT nets, packet radio networks, and the Amateur Satellite Report from AMSAT NA will furnish further news. All these sources of information, including the U-O-11 positional data and HF operations on 20, 40 and 80 meters, will make this exciting event accessible to all.

Updates

After many delays, the launch of Phase 3C is scheduled for June. AMSAT support teams from the US and West Germany will travel to Kourou, French Guiana to prepare the spacecraft for integration into the Ariane 4 booster. They need to apply thermal blankets, install antennas, and load fuel. Upon completion, a small group will remain in Kourou to monitor the satellite's vital signs and await launch day.

> ***"After many delays, the launch of Phase 3C is scheduled for June."***

RS-10/11 and Fuji-OSCAR-12 have been performing nobly lately. Both Mode A and Mode K transponders have been active on RS-11. Signals have been good, but due to enhanced 15 meter conditions, a lot of hams not purposely uplinking to the satellite are being heard though it. It's been necessary to call "CQ Satellite" to let other hamsat chasers know that the ten-meter downlink is monitored.

F-O-12 had more power problems in January, however, after further study of the power budget, the team in Japan has begun pre- senting month-long, or greater, activity schedules for modes JA (the analog mode) and JD (the digital mode). Check the AMSAT nets for further information and follow the trekkers via U-O-11. ■

AERIAL VIEW

Antenna News

Arliss Thompson W7XU
7314 SW 28th Ave.
Portland, OR 97219

Spider Quad for Ten Meters

After several years of ho-hum openings and low levels of activity, conditions are finally improving on the 28 MHz band. And while a DXer can work the world with ten watts and a dipole when that band is open, an antenna with some gain can really pay off when conditions are marginal. Not only does gain help the transmitted signal, it also increases the strength of received signals from the desired direction and knocks down potentially interfering signals coming from other areas. That combination of features often gives the station with a gain antenna quite an advantage over the operator using a dipole or ground plane and high power.

Gain antennas come in a variety ol sizes and configurations. The one described here is a spider quad. The 2-element spider quad has gain comparable to a 3-element yagi, is constructed from readily available materials, and doesn't cost an arm and a leg. Although I thought primarily of the Novice operator when I built my version of this antenna, the design is also adaptable to the 12 and 15 meter bands.

Most of hamdom is familiar with the classic quad antenna shown in Figure 1A. The spider quad, Figure 1B, is a less common version of this antenna. It has several advantages over the classic configuration, such as constant spacing between elements in multiband designs and no boom, which represents a potential savings in weight, wind loading, and cost. The chief disadvantages of the spider quad are the increased complexity of designing a spider mount, compared to mounting convential quad spreaders, and the need for longer spreaders in the boomless design. I can't argue with the need for longer spreaders with boomless quads, but the fashioning of a spider mount need not be difficult.

Mounting the Spider

The mount I used for my antenna was described by Lynda Crowley KP4DIP in a "Hints and Kinks" column some years ago (*QST*, December 1970). Her hub was low cost and easy to replicate. I haven't seen it repeated elsewhere, however, so it may be new to many hams.

The hub is constructed from a short length of steel pipe (I used a 2.5 foot section of 1.5 inch diameter water pipe that I had on hand). Make two cuts in one end of the pipe, each approximately twelve inches long, across the diameter of the pipe. The cuts should be at right angles to one another. Similar cuts are made at the other end of the pipe, taking care to make these cuts align with the first ones (see Figure 2A). This is quick work with a bandsaw, but less than fun (trust me) with a hacksaw. Leave about 6 inches of undisturbed pipe in the center in which to drill to allow attachment of a hub-to-mast clamp.

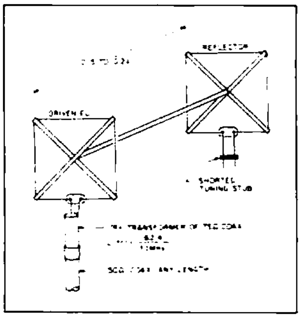


Figure 1. (a) Conventional cubical quad. Illustrated method of feeding is applicable to other designs as well.

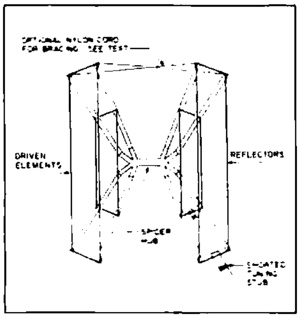


Figure 1. (b) Two-band spider quad. The tuning stubs for each band are two wires 12" long, spaced 3" apart.

Next bend the cut ends of pipe outward to form the spider itself (Figure 2B). The desired angle is 108 degrees. This angle simultaneously controls the distance between the tips of the spreader arms and the element spacing. However, the angle is not especially critical since there is ample spreader material for 10- and 12-meter band antennas and good performance is possible with a variety of spacings in the 0.15 to 0.20 wavelength region. The builder can measure the angle with a protractor or approximate the correct angle with a wooden form in the shape of a triangle 10 7.16 x 3 ⅜ x 11 inches.

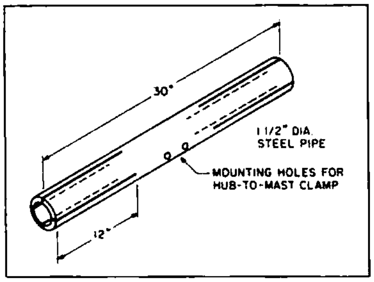


Figure 2. (a) Cuts to be made in 1.5" pipe to form spider hub.

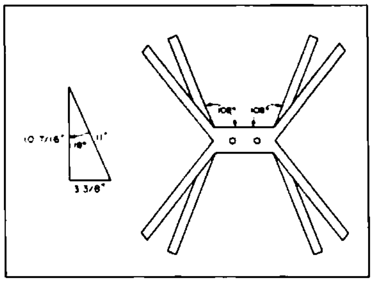


Figure 2. (b) Forming the hub. Wooden form for measuring the required 18 degree (108–90) is also depicted.

Once the spider is complete, it needs a few coats of paint to protect it from the weather.

For spreaders, I purchased 8 ten-foot lengths of 0.75 inch diameter Schedule 40 PVC pipe. The price is right at well under $2 each. These spreaders are long enough to support a 15-meter band quad, but aren't rigid enough for an antenna that size. One-inch diameter PVC (particularly with some heavy monofilament or lightweight nylon cord for added bracing, as shown in Figure 1B) should be adequate for a 15-meter model. The 0.75-inch diameter material suffices for a 10-meter band antenna. Figure 3 gives the length of the spreaders and other dimensions for each band.

I attached each spreader to its corresponding spider arm with two stainless steel hose clamps. They can also be attached by fastening spreaders to the arms with glass filament shipping tape. The shipping tape should be overwrapped with black vinyl tape to protect it from sunlight. While I have not tried the tape method, it was apparently used successfully by Mitchell N0ARQ, on his "Optimum Gain Boomless Quad" (*ARRL Antenna Compendium*, Vol. 1, pp. 11–17), and is worth consideration, particularly for keeping expenses down.

The Loops

Loop dimensions are listed in Figure 3. These dimensions are for uninsulated wire. Wire insulation may cause the resonant frequency of the antenna to be lower than the calculated value (Boucher, N., "Cubical Quad Antenna Design," *ARRL Antenna Compendium*, Vol. 1, pp. 41–45). Stranded wire is better to solid in this application since it has less tendency to break with flexing of the spreader arms. Number 14 or 16 wire is adequate. There are many ways to attach the wire to the spreader arms. The simplest is to pass the wire through holes drilled in the spreaders. An additional short piece of wire can be wrapped around the loop wire on either side of the point where it passes through the spreader arm to hold the loop in place. Loops may also be strung through lightweight insulators that have been attached to the spreaders.

Figure 4 shows two ways the quad may be fed for horizontal polarization. To match the impedance of the driven loop to that of 50Ω coax, feed the antenna either through a quarter-wave transformer of 75Ω coax, or through a gamma match. These are shown in Figures 1A and 5. A quarter-wave transformer will require a separate feedline for each band. It's a good idea to use a separate feedline for different bands in the case of the gamma match, but if necessary, feed the loops for several bands in parallel with a single length of coax (Figure 5).

BAND	DRIVEN ELEMENT	REFLECTOR	MINIMUM LENGTH OF SPREADER ARM	LENGTH OF 75Ω 1/4λ TRANSFORMER (IF USED)
10M	33'4"	36'3"	7'3"	5'8 1/2"
12M	40'4"	41'4"	8'0"	6'6"
15M	47'6"	48'8"	9'6"	7'8"

Figure 3. Spider quad dimensions.

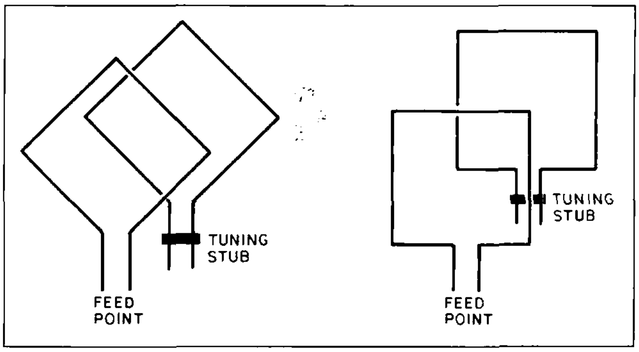


Figure 4. Two methods of feeding to obtain horizontal polarization.

A third, more complex, solution is to mount a remotely-controlled coax switch at the antenna and use that to switch between bands. Whatever the method of feeding, it's best to avoid long runs (over 50 feet) of RG-58 at these frequencies due to its relatively high losses. Use RG-8 or -213 if at all possible.

The quad performs best when the bottom of the quad is one-half wavelength or higher above ground. When mounted closer than this to the ground, radiation is reduced at the low angles commonly needed for long distance communication at 28 MHz.

Tuning the Spider

The final step is to tune the antenna for maximum performance. It's possible to use the antenna "as is," but tuning the reflector stub yields optimum performance. The reflector may be tuned either for maximum gain or for best front-to-back ratio (the latter is normally done).

Aim the back of the antenna at a nearby (but no closer than a few hundred feet) signal source and adjust the shorting bar for minimum signal. If using the gamma match feed system, it's necessary to apply a low level of power to the antenna and adjust the match for minimum SWR. If it is a multiband quad with the gamma matches connected in parallel, adjustment for minimum SWR is more involved. With that system, the taps and associated variable capacitors of the gamma matches need adjusting for minimum SWR on each band. Adjust the compensator capacitor if necessary to improve the match. By repeating those steps several times it should be possible to get a low SWR on each of the bands.

That's all there is to it. This antenna is easy to build and a good performer. Try it out as the new sunspot cycle breathes life into the higher frequency HF bands.

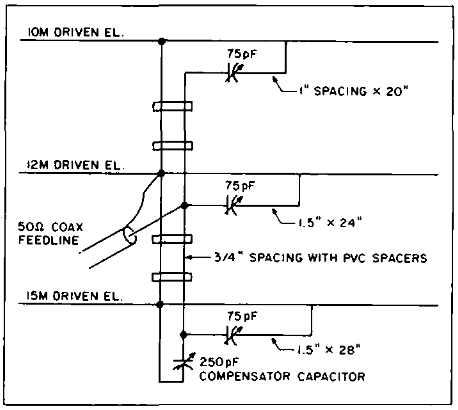


Figure 5. Details of gamma match for multiband design. Once adjusted, the variable capacitors may be replaced with fixed mica capacitors of the same value. See text for adjustment details. Each band must be adjusted separately with great care.

Number 27 on your Feedback Card

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

PROPAGATION FORECASTS

Readers have shown increasing interest in radio propagation forecasting, so 73 has asked me to expound on my method of radio propagation prediction.

I prepare the forecasts approximately two months in advance in order to meet deadlines. The government provides a summary of past data for the previous week or so and also gives an estimate of expected solar behavior for the coming month. Although they give past data in great detail with much information about the sun and earth, future estimates are very general. Indeed, they have to be. Ionospheric propagation forecasting is empirical, not exact. Future trends are estimated based on thousands of past observations plus some new material developed independently and used in concert with previous data. I, and my crystal ball, reserve the right to be wrong on occasion.

Sunspots

People have been observing solar cycles for at least 200 years. Solar cycles occur approximately every 11.2 years (they vary either way as much as a year) and are based on sun-spot observation.

Sunspots are areas on the solar disk that appear darker than surrounding areas. They are thousands of degrees cooler than sun's 100,000° surface temperature. Scientists believe the spots result from large magnetic field concentrations or vortexes having a particular polarity. They emit high concentrations of radiation and particles.

Spots disappear during the low part of a typical 11-year sunspot cycle, and are most numerous during the high part of the cycle. New spots at the beginning of the cycle appear high on the solar disk and gradually work their way down toward the solar equator as the cycle progresses. Each cycle's spots appear on the alternating halves of the sun as seen from earth. Therefore, the period for the cycle with spots the same solar longitudinal "polarity" occurs once every 22 years.

Solar flux and the maximum usable frequencies (MUFs) are low during the cycle low. Solar flux and MUF increase with the sunspot number.

Cycles within Cycles

Solar flux also varies seasonally. Further, there is a near-monthly variation due to the sun's 27-day rotation period. This means that a given area of the sun—with its peculiar characteristics—appears every 27 days.

The sun radiates all manner of electromagnetic waves and particles, including X-rays, infrared, and ultraviolet radiation. Ultraviolet radiation from the sun is the principle cause of ionization in the earth's upper atmosphere—ionization that produces the disassociation of molecules and atoms into "free" electrons and ions. The earth's ionosphere, a region of the upper atmosphere, serves as a prism that bends radio waves.

From this, you can see that the ionosphere varies from daylight to dark and from season to season. . . and year to year. There is nothing really constant about the sun's output, and it is this inconstancy that produces our variable ionosphere.

APRIL

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G	2 G–F
3 F	4 F–G	5 G	6 G	7 G	8 G–F	9 F
10 F–G	11 G	12 G–F	13 F	14 F–P	15 F	16 G
17 G	18 F–P	19 P	20 P	21 P	22 P	23 P–F
24 F	25 F–G	26 G	27 G	28 G	29 G–F	30 F

DX Forecast

Expect April to yield excellent DX opportunities on bands 10 through 20 meters, with seasonally good MUFs, somewhat longer days than in March. . . and bands open later in the day, especially with Daylight Savings Time coming toward the end of the month. The outlook for the first half of the month is Good to Fair on a daily basis, while the outlook for the last half in general is for more erratic conditions. The last week of the month looks better than the third week. Consult the daily outlook for the symbols F, G, and P, and trends from one to the other. The magnetic field will be unsettled to active on the days marked Poor, and quiet on the days marked G or F.

As always, consult WWV at 18 minutes past the hour for the present day's conditions and the previous day's conditions, plus the expected conditions for the following day. Planetary A index below about 10 will yield fair conditions (F), an A index below about 5 will yield good conditions (G), and an A index above 10 will yield poor conditions (P). Overall, the solar flux should be rising constantly and show daily values of at least 100, and sometimes up to 110 or even higher. This means excellent DX, as long as the magnetic field remains quiet.

The days centered around the 20th of the month may be exciting geophysically. Trends upward and downward from WWV reports will tell what to expect. Make use of them.

Propagation forecast for January approximated 85% accuracy for the month. Some forecasts were clearly wrong, while many others were approximately correct. The remainder were entirely correct.

Analyzing Propagation Forecasts

Forecasts are only as good as they prove to be in the event. Here's analysis of November 1987 to see how close the forecasts came to the actual conditions on each day of the month.

Symbols are as follows:

P = Poor
F = Fair
G = Good
P–F = Poor to Fair
F–P = Fair to Poor
F–G = Fair to Good
G–F = Good to Fair

The actual conditions are reflected by the condition of the magnetic field. I use the Planetary A index as reported weekly by the joint NOAA–USAF Space Environment Services Center in their *Preliminary Report and Forecast of Solar Geophysical Data*.

A = 0–5 Magnetic field quiet, conditions Good
A = 5–10 Magnetic field quiet to unsettled, conditions Good to Fair
A = 10–20 Magnetic field disturbed, conditions Fair to Poor
A = 20–30 Magnetic field at storm level, conditions Poor
A = Greater than 30 Large magnetic field storm, conditions Poor

Now for a look at the actual conditions. I circled the days when the predictions were clearly wrong and squared the days when the predictions were close, but not exact. The unmarked days show that predictions and actual conditions were the same.

Results:

5 out of 30–wrong: 16.66%
5 out of 30–close: 16.66%
20 out of 30–right: 66.66%

If the days counted as "close" and "right" are combined (and for practical operating this would be a fair assumption), then the forecast was useful 25 days out of 30, or 83.33% of the time for the month of November.

Number 28 on your Feedback card

LETTERS

From the Ham Sack

You don't have to tell me how great ham radio operators are. I am aware that they have to demonstrate a high degree of intelligence to qualify for their licenses. In addition, over the years ham operators have–again and again–given proof of a real concern for the safety and well-being of the public. I will never forget the invaluable services that they performed for the safety officers and the citizens of the Commonwealth during the blizzard of '78.

Michael S. Dukakis
Governor of Massachusetts

I agree with your results on your test of MAXCOM. I also agree with your overview on their advertising—if they would just present it as it is, and keep the price appropriate, they would have a nice product, similar to B & W.

This product has been tested by many others, all leading to the same results that you have discovered—and that is, its effectiveness is anywhere from 2 to 4 dB down from a dipole cut to length—and that's only when the MAXCOM is hooked up to the extreme 128-foot dipole. When the MAXCOM is hooked up to a "cut to length" dipole to act as the balun, radiation is even further attenuated.

Gordon West WB6NOA

I recently received your February 1988 issue and was extremely pleased to see TWO articles concerning 1750-meter operation.

Both articles referenced my monthly *Western Update*, a newsletter for Lowfers (1750-meter experimenters), but somehow it was not made clear that this is a non-profit affair, and I require 60 cents per issue (about $7 per year), together with the SASEs, in order to break even on my production costs (photocopies, halftones, etc.). Unfortunately, I am already receiving SASEs (sans donation) from many of your readers. When *Western Update* started several years ago, we handled the cost issue on a donation basis. We now have about 110 subscribers, *and* I just can't afford to carry it from my pocket.

The purpose of *Western Update* is to provide fast turnaround information (I can literally write the newsletter on my computer one day and mail it the next) concerning band conditions, which Lowfers are on what frequency, resource information, schematics, antenna designs, etc. At present, *Western Update* is the only publication of its kind in the USA.

Thank you for setting the record straight.

Jim Ericson
Lowfer beacon "EK"
184.02 kHz

You blew it! Arliss Thompson W7XU wrote the best article I've ever seen on Antenna SWR in the Aerial View Section of the February 1988 issue of *73*, and you duplicated part of it (page 90) and left out part of it (between page 90 and 91).

Would you like to hire me to proof read [*sic*] your magazine? In the age of high technology, life is confussing [*sic*] enough without stupid mistakes being made. And in a time when the U.S. *economy* is loosing [*sic*] ground to foreign competition because of lack of attention to detail, you are exhibiting a prime example of sloppy American workmanship.

R.L. Miller N8IWO
Professional Engineer

Apologies to our readers for this mistake. We are but mere humans in an electro-mechanical publishing world. The full text of the article is available for an SASE.

Now, Mr. Miller, what's your *excuse?*

. . . de NA5E

I have received several letters asking if any "typos" were in the code listing for my program listing in the January 1988 *73*. There are none, but the equations in this program are difficult to type in the first time around. The program contains many LOOPS, and when it CRASHES, it is a bear to de-bug.

Jim Cooper KD5EA
Spring TX 77386

SPECIAL EVENTS

Ham Doings Across the Country

Special Events listings will be provided by 73 magazine free of charge on a space-available basis. Announcements must be received by us by the first of the month, two months prior to the month in which the event takes place (by March 1, for example, for a May or later event). Please mail to Editorial Offices, 73 Magazine, WGE Center, Peterborough NH 03458. ATTN: Special Events

HARROGATE ENGLAND

The Darley Amateur Radio Club of North Yorkshire will operate special event station GB75USA throughout the spring as part of a joint British and American celebration of the RSGB's 75th Anniversary. The main HF activity will center on 15, 20, and 80-meter SSB bands. QSLs via G0FWG or to *Darley Amateur Radio Club, MHS, Darley, Harrogate, N. Yorkshire HG3 2RF England.*

BENTON KY
APRIL 4-5

The Marshall County Amateur Radio Association will operate KA4WWS, April 4-5 at 1800Z Sunday till 2400Z Monday to commemorate the 145th Annual Tater Day Celebration. Suggested frequencies are around the middle of the General Phone, CW bands and 10 Meter Novice band. For QSL send SASE to *Clyde Dexter KA4WWS, Route #1 Box 486, Benton KY 42025.*

CLARKSVILLE TN
APRIL 9

Clarksville Amateur Transmitting Society is having its annual swapfest on April 9th at 8 AM to 4 PM in the National Guard Armory. Reservations for tables call 615-362-3859. FCC Exams will be administered, call WD4DBJ at 615-232-6141. Talk-in on 145.805 − or 147.39 +. For more information call or write to *C.A.T.S c/o WD4DBJ, Rt 1 Box 162A, Indian Mound TN 37079.*

ROCHESTER MN
APRIL 9

Rochester Amateur Radio Club will hold its 11th Annual Rochester Area Hamfest on Saturday April 9. Set up is on Friday the 8th. Gates open at 8:30 AM. Talk-in on 146.22/82 MHz. For reservations contact *R.A.R.C. c/o WB0YEE, 2253 Nordic Ct. N.W., Rochester MN 55901; 507-288-7688.*

SPOKANE WA
APRIL 9

The Inland Empire Hamfest committee will hold its 11th Annual Inland Empire Hamfest on Saturday, April 9, at the Red Cross Bingo Hall. It starts at 8 AM until 5 PM. There will be Amateur License Exams at 1:30 PM, Upgrades and Technician-Extra. Dealine for exam applications is March 12. For more information contact *Hamfest 88 c/o W7EOU, 318 E. Courtland Ave., Spokane WA 99207.*

UPPER SADDLE RIVER NJ
APRIL 9

On April 9th the Chestnut Ridge Radio Club will sponsor a Ham Radio Flea Market. It will be held at the Educational Building, Saddle River Reformed Church. For more information on tables and times contact *Jack Meagher W2EHD, 27 Fourth St., Closter NJ 07624; 201-768-8360.*

BRAINTREE MA
APRIL 10

The South Shore Amateur Radio Club of Braintree MA will again hold its annual indoor flea market at the Viking Club on Sunday April 10th. Hours are 11 AM to 4 PM. For more information on table reservations contact *Hal Jones WB1ABM, 48 Saning Rd., N. Weymouth MA 02191; 617-335-5777.*

MADISON WI
APRIL 10

The Madison Area Repeater Association, Inc. (M.A.R.A) is pleased to announce its 16th annual Madison Swapfest which will be held on Sunday April 10th, at the Dane County Exposition Center Forum Building. Doors will open at 8 AM. Talk-in will be on the M.A.R.A. repeat, WB9AER/R, 146.16/.76. For admission tickets, table reservations, or information on commercial exhibit space write to *M.A.R.A., P.O. Box 3403, Madison WI 53704; 608-274-5153, leave a message on the answering machine.*

RALEIGH NC
APRIL 10

Raleigh, the City of Oaks, and the Raleigh Amateur Radio Society is sponsoring the 16th Annual R.A.R.S. Hamfest, NC State ARRL Convention and Computer Fair in the Graham Building at the NC State Faigrounds on April 10th. There will be many programs meetings and contests. Dealer setup is on Saturday the 9th. Talk-in on 04/64 and 28/88. For pre-registration, flyer or dealer information contact *Rollin Ransom NF4P, Rt. 5 Box 267, Zebulon NC 27597; 919-269-4406.*

AUCKLAND NEW ZEALAND
APRIL 15-25

Special Amateur Radio Station for the Centenary Celebration of Local Government in Birkenhead will operate from the Public Library of the Birkenhead City Council, for which the special call sign of ZM1BCC has been issued. It will be operated by local hams on the high frequency bands as well as VHF and UHF. Times of operations will be from 9 AM (local time) to 5 PM with later times on Thursday and Friday 21 and 22 of April. A full-colour QSL card has been designed, showing our proximity to Auckland City. It will be of particular interest to us in Birkenhead to contact other hams who live in districts of Birkenhead, Birkdale, or Beach Haven in other parts of the world. For more information contact *Ray Tout ZL1BXC, Branch 29 NZART, 4 Mayall Ave., Birkenhead Auckland 10, New Zealand.*

ANGLETON TX
APRIL 16

Brazosfest '88 will be held on Saturday, April 16th at the Brazoria County Fairgrounds, from 8 AM to 5 PM. Features will include a Swapfest, technical seminars, Amateur Radio examinations and exhibits. Talk-in on 147.980/380. For more information send a SASE to *Mark Nace N5KAE, 111 Carnation St., Lake Jackson TX 77566.*

AUBURN NY
APRIL 16

The Auburn Amateur Radio Association will hold its annual Hamfest on Saturday April 16th, at the Aurelius Volunteer Fire Department. It opens at 8 AM to 4 PM. For more information on tables reservations contact *James P. Nash N2DTG, 114 Dunning Ave., Auburn NY 13021; 315-253-0512.*

FLEMINGTON NJ
APRIL 16

Cherryville Repeater Association is sponsoring its annual Hamfest on Saturday, April 16th at the Hunterdon Central High School Field House. Doors open at 8 AM. Talk-in on 146.52, 147.975/.375, 147.615/.015, 222.52/224.12, and 449.85/444.85 MHz. For table reservations and advance ticket sales, write or call *Marty Grozinski NS2K, 6 Kirkbridge Rd., Flemington NJ 08822; 201-788-4080.*

LAWTON OK
APRIL 16

Ft. Sill Amateur Radio Club Annual Event. Our 41st year. Starts at 8 AM to 6 PM on April 16 at the Comanche County Fairgrounds. Again, it's an old fashioned one-day Swapfest. Preregistration needed only for tables. For more information contact *AA5DS Edwin, 4624 NE Bell Ave., Lawton OK 73507.*

COLUMBIA TN
APRIL 17

The Maury Amateur Radio Club will sponsor its 2nd annual indoor Hamfest from 8 AM to 4 PM at Maury County Park in the Baker Building. Talk-in on 147.72/.12. To reserve tables or get more information contact *George Russell WB4JCR, P.O. Box 832, Columbia TN 38402; 615-388-0577.*

CAMBRIDGE MA
APRIL 17

Tailgate electronics, computer and amateur radio flea market is sponsored by the MIT UHF Repeater Association and the MIT Electronics Research Society. Starting at 9 AM to 4 PM. Talk-in on 146.52, 449.725/444.725 (PL 2A) W1XM/R. Mail advanced reservations before April 5th to *W2XM, c/o Mike Strange, 229 Commonwealth Ave., Boston MA 02116.*

SOUTHINGTON CT
APRIL 17

The Southington Amateur Radio Association is pleased to announce their 5th annual Flea Market on Sunday, April 17th at the Southington National Guard Armory. Talk-in on 146.28/88 and 145.600 Simplex. For more infor-

mation contact *Chet KA1ILH, 138 ½ Summit St., Plantsville CT 06479.*

SULLIVAN IL
APRIL 17

The Moultrie Amateur Radio Klub (MARK) Hamfest will be held at the Moultrie County 4-H Fairgrounds, from 8 AM to 3 PM. Talk-in on .055/.655 and 52. Tests will be given for Amateur licenses by preregistration only. Tickets in advance. For more information write *MARK, P.O. Box 79, Sullivan IL 61951; or call Vernon E. Jack K9SWY at 217-728-7596.*

WILLIAMSPORT MD
APRIL 18-24

Special event amateur radio station WA9EOP will be on the air April 18-24 to celebrate Maryland Odd Fellow Week. Members of the Odd Fellow Ham Club, Radio Amateurs Worldwide and Shortwave Listeners are invited to listen for this special station which may be on any of the following suggested frequencies-MHz phone 3.870, 7.240, 14.265, 21.375, 28.375. CW (Morse Code) operation is anticipated at 7.120 MHz and FM at 147.09 MHz may be utilized. A special commemorative certificate will be offered for an amateur contact (OSO) plus a QSL card and a SASE. Accurate shortwave reception reports will be accepted in lieu of a two way contact for short wave listeners. Send details of the QSO and SASE to *Page Pyne WA3EOP, 109 S. Artizan St., Williamsport MD 21795, for this special award.*

VISALIA CA
APRIL 22-24

The 1988 International DX Convention will be held at the Grosvenor Holiday Inn. This special event is sponsored by The Southern California DX Club on April 22 thru the 24. For more information contact *Don Bostrom N6IC, 4447 Atol Ave., Sherman Oaks Ca 91423.*

CORNWALL ENGLAND
APRIL 23

The Cornish Radio Amateur Club, Cornwall England, and five additional stations worldwide, representing early Marconi Station locations, will celebrate the birthday of Guglielmo Marconi on April 23, from 0000Z to 2400Z. Participating special event stations will be GB4IMD, VO1IMD, VE1IMD, EI2IMD, IY4FGM, and K1VV/IMD. Operations will be in the general class bands with special QSLs. For 3 IRCs, a certificate for working 5 of the 6 stations is available from the Cornish Radio Amateur Club, P.O. Box 100, Truro, Cornwall England. For more information contact *R.J. Donerty K1VV, 153 County St., Lakeville MA 02347.*

GALENA IL
APRIL 23

The Great River ARC of Dubuque, Iowa, will operate N9FVN from 15:00Z until 21:00Z, April 23rd, at the site of the annual Boy Scouts of America U.S. Grant Pilgrimage in Galena, Illinois. Frequencies will be in the lower 20 kHz of the general bands. Station N9FVN will also operate CW in the lower 25 kHz of the 80 and 40 meter bands and voice in the lower 25 kHz of 10 meter bands. Scouts will also be able to send messages to parents and relatives. For QSL card send SASE to *N9FVN, R.R. 1, Shullsburg WI 53586.*

LAS CRUCES NM
APRIL 23-24

The Mesilla Valley Radio Club is sponsoring the 24th annual Amateur Radio Extravaganza and Bean Feed on April 23 thru the 24. There will be VEC exams, technical information, and many more. Talk-in on 146.04/146.64 and 146.16/146.76. For more information write or call *Karl Wess WF5A, 712 Stagecoach Dr., Las Cruces NM 88001; day 505-646-5132, night 505-522-1172.*

PHILADELPHIA PA
APRIL 23-24

The Olympia Radio Amateur Club will celebrate the Anniversity of the United States Submarine Service by operating from the *USS Becuna*, a World War II Submarine and the *USS Olympia*, flagship of Admiral Dewey in 1898. Transmissions can be heard beginning April 23, 1300Z until 2000Z. On April 24 frequencies for CW are 3.590; 3.725; 7.050; 7.125; 14.050; 21.090; 21.150 and phone frequencies 3.890; 7.240; 14.250; 21.360; 28;325; 28.600 (all frequencies within 10 kHz). Two meter operation: 144.225 sideband and 144.270 FM. The ORAC call is WA3BAT. For additional inquiries about the ship's history or the club's operation and QSL information please write to *Olympia Radio Amateur Club, P.O. Box 928, Philadelphia PA 19105.*

FITCHBURG MA
APRIL 24

The Montachusett ARA will hold a Flea Market at the George Wallace Civic Center. Doors open at 10 AM until 3 PM. Talk-in on 144.85/145.45 and 146.52. For table reservations contact *James Beauegard KB1AY, 7 Mountion Ave., Fitchburg MA 01420.*

HAYS KS
APRIL 24

The 3rd annual Hays Hamfest will be held on Sunday April 24, just south of 13th and Canterbury. For more information contact *Andy Oldham N0FBS, 117 8th St., Wakeeney KS 67672.*

GREENVILLE SC
APRIL 30-MAY 1

The Blue Ridge Amateur Radio Society proudly sponsors the 49th Annual Greenville Hamfest and Electronic Flea Market at the American Legion Fairgrounds on April 30 thru the 1st of May. Amateur Radio License Exams (walk in). Indoor/outdoor Electronic and Computer Flea Market starting on Saturday at 8 AM to 5 PM; Sunday 8 AM to 3 PM. For advanced tickets or additional information, please send a SASE to *BRARS, P.O. Box 6751, Greenville SC 29606.*

DAYTON OH
APRIL 24-26

Dayton's annual Hamvention will be held on April 24 thru the 26th. The Flea Market will open at 12 until 6 PM on the 24th and 6 AM to 5 PM on the 25th, and from 6 AM to 4 PM on the 26th. You must have a General Admission ticket to enter the flea market area. The ticket is valid for Friday, Saturday and Sunday. All flea market spaces are sold in advance. Watch for our ad and order your tickets as soon as possible after January 1. Ticket requests postmarketed prior to January 1 will be returned. Either talk-in on 146.34/94 all weekend or 146.31/91 Saturday and Sunday, or 222.34/223.94 Friday noon thru Sunday. A special Hamvention certificate will be sent for contacts made with W8BI during the Hamvention. Send your QSL card and SASE to *Box 44, Dayton OH 45401. (ATTN: DARA Van). For exhibits information write to the same address with the ATTN: Exhibits Chairman.*

CONWAY ARKANSAS
APRIL 30

The Faulkner County ARC will operate W5AUU on Saturday, April 30 from 1500Z to 2100Z in celebration of Toad Suck Daze. The suggested frequency is 14.250. Send QSL with large SASE to *Kelly Boswell KA5MGL, 599 4th Avenue, Conway AR 72032-5805.*

SANDWICH IL
MAY 1

The Kishwaukee Amateur Radio Club is sponsoring their 33rd annual hamfest the first Sunday in May at the Sandwich Fairgrounds in Sandwich IL. Hours are 8 AM to 1 PM. Overnight camping is permitted, but there are no hook-ups. Reserved tables are $5 in advance. Tickets are $2 in advance and $3 at the door. Talk-in is 1373. For more information, contact *Howard Newquist, Kishwaukee Amateur Radio Club, P.O. Box 264, Sycamore, IL 60178.*

LONG ISLAND NY
MAY 1

The Suffolk County Radio Club Indoor-Outdoor Electronic Flea Market will be held on Sunday, May 1 from 8 AM to 2 PM at Republic Lodge No. 1987, Long Island NY. There will be a refreshment stand on the premises and plenty of free parking. General admission is $3 (spouse and children under 12 free). Indoor sellers' tables are $10 each and outdoor space is $7. Each includes one free admission. Talk-in on 144.61/145.21 and 146.52 simplex. For additional information, contact *Bill Sullivan N2ETG at (516) 689-9871 in the evenings.*

WHEATON IL
MAY 7

Boy Scouts of the DuPage Area Council will operate the Wheaton Community Radio Amateurs Club station W9CCU from the DuPage County fairgrounds at 0400 to 0900 on May 7 with WCRA youth as control operators. This Special Event station, an active part of Scoutarama 88, with the theme "Scouting America's High," is intended to encourage Radio as a hobby of local youth. Suggested frequencies: 28.390, 14.290, and 146.490 FM. For certificate, send an SASE to: *WCRA, P.O. Box OSL, Wheaton IL 60189. Attn: Scoutarama.*

HAM PROFILES

Leonid Labutin UA3CR

Bryan Hastings KA1HY
73 Magazine *staff*

73 Magazine had the great fortune to obtain an interview with one of the Soviet Union's premier hams: Leonid Labutin UA3CR. "Lyonya" is the Chief of Communications in the Soviet Union for the joint Canadian/Soviet polar skitrek. The expedition left a northern USSR island in February, and expects to arrive at Ellesmere Island in Canada's Northwest Territories three months later. See "Look North!" in the January 1988 issue of *73* Magazine for more information on this trek.

The Soviet Union has a very active amateur population, and the *Callbook* lists over 18,000 Soviet hams. Despite this, not very much is known about the state of amateur radio in this vast country, which under *glasnost'* is just beginning in earnest to open up to the West. Leonid provides us with a look into his personal experience and sheds light on the state of amateur radio in this powerful and mysterious nation.

73: Let's begin by finding out a little about yourself.

L.L.: OK, well, I've lived all my life in Moscow. I studied at the Radiotechnical faculty at Mayakovskyi Institute, and finished up there as a radio construction engineer.

I have a wife and a 21-year-old son. He's in his last year of Electrical Engineering at the Moscow Electro-Technical Institute. He wants to do his thesis on packet radio.

73: When did you first become interested in ham radio?

L.L.: I made my first rig in 1939, when I was 11 years old. It was a crystal detector. I used a very long antenna with it and received a few stations on the medium- and long-wave bands.

73: Was it hard to get permission to put up an antenna in Moscow?

L.L.: No, not then, but it's more difficult now. Before, the administration didn't pay too much attention to outside views, but now there are several organizations against aerials, because they feel they are eyesores.

73: Did you have an Elmer? Who first got you involved in amateur radio?

L.L.: Yes, at first it was my father. He was not a ham, but an SWLer. I really became interested in shortwave after reading a remarkable article in our journal *Radio* by one of our first ham-polar researchers, Ernest Krenkilo RAEM [*an early Soviet callsign—Ed.*] He spent months at a time at a North Pole research station as the radioman.

He was also president of the Radio Sports federation in the USSR. I had the good fortune to get to know him—his dacha was close to mine and we often went out together.

73: Have you been on a DXpedition before?

L.L.: Yes, I went to Franz Josef Land in 1962 with SSB radios. It was a brand new country on SSB. That was my first trip to the Arctic.

73: Are there any hams there now?

L.L.: Yes, one I think.

73: Is your wife a ham?

L.L.: No, but she minds me being one.

73: What other hobbies do you have?

L.L.: I love to listen to classical music. I also like to read contemporary historical novels and cross-country ski.

73: You were involved in building the first Soviet ham satellites, is that right?

L.L.: That's right. I worked on RS-1 and RS-2, which went into orbit in 1978.

73: There are now 11 ham satellites from the USSR?

L.L.: Yes. Satellites RS-3 through RS-8 were made very much in the mold of the first two.

73: What aspect(s) of amateur radio interest you the most?

L.L.: It differs at different times. I've always been interested in new developments. At first SSB, then satellite communications, and now packet radio.

73: Is there packet radio now in the Soviet Union?

L.L.: So far, no. We are working hard to get the administration to allow hams to experiment with packet radio.

L.L.: There is a similar document in Moscow. Only, to put up an aerial, we must first apply to the appropriate ministry and show our amateur license and give the details of the erection. Then, they send us permission.

73: How long do you have to wait for this permission?

L.L.: It varies. . . sometimes a long time, sometimes not. Some cities don't have the document system, and in these places it's harder.

Leonid UA3CR/VE3 on packet. This photo was taken at the home of Tom Atkins VE3CDM of Toronto, Ontario, where Leonid spent much of his time during his two-week visit to Canada before Christmas. Tom is the Canadian Coordinator for the Polar Bridge skitrek.

73: Are there a lot of hams in the Soviet Union?

L.L.: There's a fair number—probably around 50,000. About half of them have their own stations.

73: What's the equivalent organization in the USSR for the FCC?

L.L.: There's an organization under the auspices of the Ministry of Communications that administers the exams to hams. The Government Inspector of Electro-communications grant licenses to hams to transmit.

73: In the US, we have a government ruling—PRB-1—permitting hams to put up antennas in cities, even those cities with local sanctions against antenna and tower erection. How is it in the Soviet Union?

73: Are there many ham nets in the Soviet Union?

L.L.: Yes. DX nets are very popular, especially in the Ukraine.

73: Yes, I've spoken with many Russian DXers. Most only want to say, "Hello, ur 5 x 9 OM, vy gud 73."

L.L.: Yes, for them it's just sport. There's a lot of radio sport in the USSR and not enough *tekniki*. This is a bad situation.

73: Are most of the people in the Soviet Union who want to become hams from technical backgrounds?

L.L.: They're from all different backgrounds. Many are from technical backgrounds. It seems that more hams there than here come from radio technology background—perhaps 20–30%.

73: Are there a lot of female hams in the Soviet Union?

L.L.: Not so many—even less than here. Most hams' girlfriends tolerate their hobby until they get married, and then completely reject it.

There are exceptions, however. Yuri UA3HR's XYL, Alla RA3AZ, just got her ticket. She's very keen on amateur radio and helped us quite a bit to prepare for this DXpedition.

73: Is *Radio* the best known journal for amateur radio in the Soviet Union?

L.L.: Yes.

73: Is there a journal devoted entirely to amateur radio?

L.L.: Unfortunately, no.

73: Is it hard to find amateur radio journals from the West in Moscow? For example, can you buy *73 Magazine* in Moscow?

L.L.: It's impossible to buy it there. It's possible, however, to subscribe to some Western journals.

73: Is *QST* available?

L.L.: We get it only by reproduction. As well, it arrives late, and we don't get to spend much time with it. We get this at the library. A lot of hams also get a magazine by their "personal route." *[Black market–Ed.]*

73: Do you have any well-known people from diverse backgrounds who are hams? We have from the US, for example, Barry Goldwater K7UGA a well-known statesman, and Martin Brando FO8GJ, a well-known movie actor, to name a few.

L.L.: No, there are no such people in the USSR. *[There was, however, Yuri Gagarin UA1LO, the first man in space–Ed.]*

73: Do Soviet hams have microcomputers?

L.L.: Microcomputers are becoming widespread here, especially after the publication in *Radio* of the detailed construction plans for the *Radio* 86 RK. It's a computer for amateur radio purposes that uses a Russian version of the Intel 8080 microprocessor. Many hams have built this computer.

73: There is a Russian version of an Apple model called the *Agat*. Is this popular among hams?

L.L.: A few hams have it, but it's not very popular, mainly because it's so expensive. Another relatively popular computer is the *Mikrosha*, issued to industry. The *Elektronika* VK-0010 is a microcomputer issued to schools, but it's fairly popular among hams, too.

We have several computers at home. For example, the Sinclair ZX spectrum, for which I have a lot of amateur radio programs for satellite communications and HF propagation. My son and I built several computers, including the *Radio* 86 RK. We also have the *Elektronika* 0010, and I recently bought the Sharp DC-1276. It's a special pocket computer to calculate orbits using Karl Meinzer's DJ4ZC program.

73: Can you relate any specifically Russian ham jargon words?

L.L.: There's one I can think of. We often address each other as Tov *[short for* tovarishch, *meaning "comrade"–Ed.]*

73: Well, we've arrived at the end of the interview. One last question: Do you find a big difference between hams here and in the Soviet Union?

L.L.: Yes, and this is a point I want to emphasize. Many amateurs here have a great interest in the latest developments in the hobby. I encourage Soviet hams to begin to focus more on the technical side of amateur radio. We have a lot of "sportmen." such as DX contesters, but we really need to get more experimenters, more people interested in keeping up with the latest developments. 73

Number 38 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free, on a space available basis. To make our job easier and to ensure your listing is correct, please type or print your request clearly on a full (8½ x 11) sheet of paper. Double space and use upper and lower case letters where appropriate. Also, write numbers carefully—a 1, for example, can be read as an l or an i or a 7. Thanks.

I am looking for a manual or any information on a "CW Sendin' Machine" model No. 2048 electronic memory keyer. I will pay for the copy cost.

Rocky Wilson KB5CXN
2516 Quil Ridge
Denton TX 76201

TEN METER UFO NET being planned. Net would meet weekly in Novice sub-band to exchange information about unidentified flying objects and related phenomena. Your input is needed. Please communicate name, callsign, license class, suggested day and time to:

David L. Dobbs K8NQN
6612 Pleasant Street
Cincinnati OH 45227

I am looking for the schematic and alignment data for the Hallicrafters Models S-38 and S-76 receivers. Also any info on converting the Heath SB 650 frequency display from Nixie tubes to LED displays. I will pay for copy and mailing costs.

John A. Poplawski, Sr. WB2GFR
9 East 15th Street
Bayonne NJ 07002

WANTED: Schematic diagram for Regency model HR-312 2 meter radio. Will pay copying costs.

Rick Thompson N0HKE
217 57th Place
Fridley MN 55432

I am desperately looking for schematics and services information for the Macintosh Plus, especially the power supply/sweep board.

Tom Cronick N5FOI
2010 W. 8th Street
Odessa TX 79763

I need a schematic/services info for a Gemtronics Model GT-25 VHF Marine-Band transceiver. Thanks.

Bob Raker WB8ZFF
2459 Ambassador Drive
Cincinnati OH 45231

Need schematic or photocopy of manuals for the following: Gonset 3-30 converter, Hallicrafter S53A and S85 receiver. Will gladly pay copying and mailing costs.

Cleve Svetfik K8NZV
2545 Brainard Road
Cleveland OH 44124-4503

WANTED: Service manual and schematic for YAESU FT-2F, 2 meter transceiver. Will pay for duplication and mailing.

Frank Ivey
35 Mahonia Cr.
Sierra Vista AZ 85635

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LEARN CODE on your IBM-PC (or compatible) or Commodore C64/128. CODE-PRO takes you from no knowledge to proficient copy. $10 plus $2 S&H. Specify computer. TRIO TECHNOLOGY, Dept. 861, PO Box 402, Palm Bay FL 32906. BNB490

POST CARD QSL KIT Converts post cards, photos to QSLs! Stamp brings circular K-K Labels, PO Box 412, Troy NY 12181-0412. BNB498

COMMODORE REPAIRS... COMMODORE CHIPS...COMMODORE PARTS... See our display ad in this issue for details "THE COMMODORE DIAGNOSTICIAN". An absolute invaluable tool for fixing your own Commodore 64/1541 disk drives. It diagnoses 72 variables and tells you what chips are faulty. Many other features also. $6.95 + $1. UPS. Kasara Microsystems, Inc., 38 Murray hill Drive, Spring Valley, NY 10977, 1-800-248-2983 (Nationwide) or 914-356-3131. BNB529

SUPERFAST MORSE CODE SUPEREASY Subliminal cassette. $10. LEARN MORSE CODE IN 1 HOUR. Amazing new supereasy technique. $10. Both $17. Moneyback guarantee. Free catalog. SASE. Bahr, Dept 73-2, 2549 Temple, Palmbay FL 32905. BNB531

SB-220 OWNERS!—Enhance performance—add new features. 11 step-by-step mods which include tuned-input 6- and 160-meter operation, heavy-duty power supply mods, full QSK operation, solid-state bias control, and many more. Source of parts included. One time 50% rebate for new mods submitted and two free updates. 10 pages of tech info on the 3-500Z. Order today—$10 per copy plus $1 postage. SASE for info. Bob Kozlarek WA2SOO, 69 Memorial Place, Elmwood Park NJ 07407. BNB581

WANTED: Lafayette PrivaCom 3C, 525, 625, or GE 5813B. RADIO, 2053 Mohave Dr., Dayton OH 45431. BNB589

MARCO: Medical Amateur Radio Council, operates daily and Sunday nets. Medically oriented amateurs (physicians, dentists, veterinarians, nurses, therapists, etc.) invited to join. For information, write MARCO, Box 73's, Acme, PA 15610. BNB612

WANTED: Equipment and related Items. The Radio Club of Junior High School 22 NYC, Inc., is a non-profit organization, granted 501(c)(3) status by the IRS, incorporated under the laws of the State of New York with the goal of using the theme of Ham Radio to further and enhance the education of young people. Your property donation would be greatly appreciated and acknowledge with a receipt for your tax deductible contribution. Please contact WB2JKJ using the callbook or telephone 516-674-4072 24 hours, seven days a week. Thank you! BNB621

WRITTEN EXAMS SUPEREASY. Memory aids from psychologist/engineer cut studytime 50%. Novice, Tech, Gen: $5 each. Advanced, Extra: $10 each. Moneyback guarantee. Bahr, Dept. 73-2, 2549 Temple, Palmbay FL 32905. BNB624

HOMEBREW PROJECTS LIST. SASE WB2EUF, Box 708, East, Hampton NY 11937. BNB626.

DEAD BATTERY PACK??? NiCds/Inserts/Rebuilding. Replacement inserts, less wires/plugs: ICOM BP2 $17.95. BP3(Std.) $16.95, BP5 $23.95, Kenwood: PB24 $19.95, PB25/25H/26 $24.95, Tempo: S1(270mAh) $21.95, S1,2,4,5,15(450mAh) $22.95, Azden: 300 $19.95 Ten-Tec: 2991 $24.95, Santec: 144 w/plug $21.95. Yaesu: 207/208R (w/case) $23.95. For rebuilding; add $3 to install in ICOM-Kenwood. Motorola, GE, Phone packs, others; SASE quotes/info. In PA add 6%. Add $2 S&H/order. CUNARD ASSOCIATES, R.D.6 Box 104, Bedford PA 15522. BNB628

R-390A RECEIVER: $115, electronically complete, reparable. (Government- removed meters, operation unaffected). R-390A parts: Info SASE. CPRC-26 Manpack Radio, 6 meter FM, with antenna, crystal, handset: $22.50, $42.50/pair, $97.50/six. H-251 Military Communications Headphones: $7.50. Add $4.50/piece shipping, $9 maximum, except R-390A shipped collect. Baytronics, Box 591, Sandusky OH 44870. BNB649

AMATEUR RADIO STAMPS for collectors. Israel $5. Luxembourg $1.50. Send SASE for complete list to Phil Sager WB4FDT, 126 Whiting Lane, West Hartford CT 06119. BNB651

ROSS $$$$ NEW SPECIALS: Kenwood TS-440S/WAT $1009.90, TM-751A $???.90, TM-221A $354.90, TS-140 $764.90 TM-2430A $379.90 TR-851A $604.90 AEA PK-64HFM $169.90 ICOM IC-38A $349.90 IC-04AT $374.50 IC-290H $496.90 IC-781A $5939.90 MICRO 2AT $274.90 Yaesu FT-73RTT $275.90 FT-726R $789.90 All L.T.O. Phone or send SASE for pricing on popular items. Over 8772 ham-related items in stock for immediate shipment. *Mention ad.* Prices cash, F.O.B. Preston. We close at 2:00 Saturdays and Mondays. ROSS DISTRIBUTING COMPANY, 78 South State, Preston ID 83263 208-852-0830 P.O. Box 234. BNB654

TEN-TEC ARGONAUT WANTED State s/n, condition, accessories. Rod Sharp N5NM, Box 2169, Santa Fe NM 87504; 505-988-2305. BNB660

ATLAS 350-XL WANTED State s/n, condition, accessories. Rod Sharp N5NM, Box 2169, Santa Fe NM 87504; 505-988-2305. BNB661

"HAMLOG" COMPUTER PROGRAMS 17 modules. Full features. Auto-logs, 7-band WAS/DXXCC. Apple $19.95. IBM, Kaypro, Tandy, C-128 $24.95. KA1AWH, PB 2015, Peabody MA 01960. BNB666

K1BV DX AWARDS DIRECTORY complete rules for over 800 certificates, 200 pages. $14 Postpaid. Ted Melinosky, 525 Foster St., South Windsor CT 06074-2936. BNB672

"QSLs & RUBBER STAMPS—TOP QUALITY! States, World Maps, USA, Key, Shuttle, Globe QSLs. Report Form Rubber Stamps. More! Samples $1. (Refundable With Order). Ebbert Graphics D-7, Box 70, Westerville OH 43081" BNB675

SOLDERING STATION and TOOLS European and American. Free catalog. Robert W. Mink Import-Export, Box 6437S, Fair Haven NJ 07704. 201-758-8388. BNB682

CODE PROGRAMS. Apple/C-64-128. 37 Modes, Graphics, Lessons, Wrdprcsr, Menus. LARESCO, POB 2018-ST, Calumet City IL 60409. 312-891-3279. BNB689

EASY CODE By the Old Master, 90 min. Learning tape $7. 60 min. Practice tapes $6 each, any speed. Specify. Add $1 S & H. Write: The Old Master, Box 29013, Atlanta GA 30359-0013. BNB690

101 + CODE/THEORY EXAM PASSING TIPS. $1 PLUS SASE. Bahr, Dept 73-2, 2549 Temple, Palmbay FL 32905. BNB691

CALLSIGN/NAME BADGES. Snazzy and Unique. SASE FOR PRICE LIST. BADGES, P.O.B. 637, Louisburg KS 66053. BNB693

MANUALS for test equipment. 1000's in stock. Write for availability and price. JBM, 7061 Hagvenhurst #207B, Van Nuys CA 91406. BNB695

INDIVIDUAL PHOTOFACT FOLDERS #1 to #1400, $3. #1401 up, $5. Sams Books, $6. Postpaid. Allen Loeb, 414 Chestnut Lane, East Meadow NY 11554. BNB696

CHASSIS AND CABINET KITS SASE; K3IWK, 5120 Harmony Grove Road, Dover PA 17315. BNB698

CALL SIGN BADGES: Custom license plate holders. Personal, distinctive. Club discounts. SASE. WB3GND, Box 750, Clinton MD 20735. 301-248-7302. BNB699

WANTED: Military radios and related equipment circa WWII. Collections or single items. KA1GON, 617-396-9354 or write, 501 Mystic Valley Pkwy., Medford MA 02155. BNB700

HAM RADIO SOFTWARE for IBMs and compatibles. "HAM-LOG" logs your QSO's, sorts and searches by call, date, etc., and prints your QSL card mailing labels. $10. "HAM-CODE" sends you random code, or type in letters from the keyboard. You select the speed and tone. $10. "HAM-AWARD" tracks your progress toward DXCC, WAS, WAC, and COUNTRY HUNTERS awards. $10. "HAM-CLOCK" displays a full color world map and gives you the time in major cities. Shows the edge of night and the time in all time zones. Color monitor required. $10. QUEST ELECTRONICS, 938 BANNOCK, DENVER CO 80204. 303-623-7700. BNB704

BUSINESS OPPORTUNITY: Profitable communications business, CB/HAM sales and services, 23 years, high return, large and faithful following, Long Island NY. Owner retiring 516-423-3614. BNB705

QUALITY QSL CARDS and rubber stamps. Send 39¢ postage or SASE for samples. New stock designs or custom cards from your black ink artwork. Sandollar Press, P.O. Box 30726, Santa Barbara CA 93130. BNB706

PACK RADIO AMATEUR Announcing a new heavy duty C-64 Commodore replacement power supply especially for the

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Barter 'N' Buy advertising must pertain to ham radio products or services.

☐ **Individual (noncommercial)**........................ **25¢ per word**

☐ **Commercial**.................................... **60¢ per word**

Prepayment required. *Count only the words in the text. Your address is free.* **73 cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue. Please print clearly or type (double-spaced).**

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No discounts or commissions are available. Copy must be received in Peterborough by the fifth of the second month preceding the cover date. Make checks payable to *73* Magazine and send to: Barter 'N' Buy, *73* Magazine, WGE Center, Peterborough NH 03458.

PACKET RADIO AMATEUR. The new higher amperage output will NOW allow for 24 hour continuous "Packet" operation without voltage change or failure which the existing unit can succumb to. This heavy duty power supply also has a heavier heat sink and is an exact physical replacement for the original unit. Over 52% of Commodore 64 failures can be directly related to the original power supply. $27.95 plus $3 UPS shipping. Kasara Microsystems, Inc., 38 Murray Hill Drive, Spring Valley NY 10977, 1-800-248-2983 (Nationwide) or 914-356-3131. BNB707

DRAKE TR-3 XCVR, W. P/S $365. Drake RV-3 $85; Hallicrafters SR-46 6M XCVR, $50; Hitachi C.B., $10. Klaus Spies, Lock-box 48185, Niles IL 60648-0185 BNB708

ROSS $$$$ USED April SPECIALS: TS-820S/WCWFL $549.90, AT-200 $119.90, AT-130 $119.90 MC-85 $94.50 Yaesu DC-200 $59.40, FP-707 $109.90, FC-901 $169.90, FT-221 $229.90, FR-101SD $349.90, SWAN 102BX $459.90, Phone or send SASE for used items list. Over 8,777 NEW ham items in stock. Mention ad. PRICES CASH. FOB Preston. We close at 2:00 Saturdays and Mondays. Ross Distributing Co., P.O. Box 234, 78 South Street, Preston ID 83263. 208-852-0830 BNB709

WANTED: Sony 330K (with tape recorder), 320K (without tape recorder) and Sony CRF1 receivers. Please call Mathew Wolf at 713-871-9000 BNB710

KNIGHT VTVM Model KG-625 need rotary selector switch, or parts. R. Flynn, 220 So. Lomita St., Burbank CA 91506. BNB711

NOVICE/TECHNICIAN BOOK "Basic Guide to VHF/UHF Ham Radio" is a great introduction for the beginning or prospective repeater operator on the 2M/1¼M/70CM bands. Covers propagation, equipment operation, antennas, repeater activities and procedures, contests and awards. $6.95 + $1 PH 86p. Request signed copy. Send SASE for flyers. Ed Noll W3FOJ, Books and Antennas, POB 75 Chalfont PA 18914. BNB712

NEW ANTENNA DESIGN design delivers 30dB gain over a dipole on 80-10 Meters. Complete plans $5 Postpaid Brochure: $1. KR2F, R. Christie, P.O. Box 69, Queens Village STN., Jamaica NY 11428. BNB713

INTRODUCING HAM KIT/64 for the Commodore 64/128. This completely menu driven disk contains CODE MASTER/64 a complete and versatile code practice program, with CPO that recognizes a direct code key connection at joystick port, flexible speed adjustment, single or group character testing, optional Farnsworth method, instructions included. Also on disk ANTENNA TAPEMEASURE a informative and comprehensive antenna construction aid with graphic illustrations, line of sight calculator and much more. And as a free bonus a minimuff propagation program. Send $19.95 (CA add 6%) to: SOLAR WIND SOFTWARE, 243 W. Harvard Blvd. Box 188, Santa Paula CA 93060, 805-525-3504. BNB714

WANT DRAKE VFO RV-7S. Meyer Minchen, AG5G, 1753 North Blvd., Houston TX 77098. 713-622-6161 (24 hrs) BNB715

ORLANDO FLORIDA-50 FOOT ROHN 25 Tower with tribander and ham 3 rotor, $75,900. Also includes 3 bedroom, 2 bath Ranch Home, 1500 square feet, central Air/Heat, 2 car garage, fully landscaped, sprinklers, one of Orange County's Highest Points 130 ASL. Minutes from Disney World/Epcot. Pat Paris WD4LXN, 6428 Undine Way, Orland FL 32818 305-298-9424. BNB716

MAJOR BRAND HAM EQUIPMENT Butternut, Hustler, Larsen, MFJ, Mobile-Mark and much more. For information call Key Communications ETC. Inc., Berwyn IL 312-795-1314. BNB717

UNLOCK THE POWER OF YOUR HEATH COUNTER. IM-2400 owners, easy one evening kit yields two decades greater resolution. Measure things you thought you'd have to buy another counter for. You won't believe the difference. $12.95 for kit #1041 to L&R Distributing, P.O. Box 4643, Northbrook IL 60062 BNB718

PACKET PACKET. Homebrew a $25 interface and operate packet radio with Commodore 64 or 128. Information packet and schematics $6. Free program disc. Nona Norman N8CKS, 41991 Emerson Court, Elyria OH 44035 BNB719

C64 & 1541 12v CONVERSION Power your C64 & 1541 from 13.8vdc & have AC/DC capability (May require you to use the ext. power opt. on User-Port Hdwe if powered by int. 9vac instead of 5vdc line). Power Supply/Timebase Kit $29.95 1541 D/D opt. add $9.95. Assd w/D-D opt. $49.95 (Simple C64/1541 mods req'd). $2.00 S/H C.Check/M.O. to N7FAE, P.O. Box 373, Bonanza OR 97623 BNB720

1988 NORTH AMERICAN 6 METER REPEATER DIRECTORY and 50 MHz SSB/Beacon Directory now available $15.00 for both - Postal Money Orders preferred. Harry School KA3B, 1606 South Newkirk Street, Philadelphia PA 19145. BNB721

WANTED: Drake R74 Receiver. Tony Ficarra, 144 Gladstone Ave., Wollongong, NSW AUSTRALIA 2500. BNB722

BEAM HEADINGS FROM YOUR QTH to over 1000 locations worldwide! Distinctive Laser Printing with your call and QTH on each page makes a handsome and useful addition to your desktop. Send call, QTH, and check for $4.95 to C. Price WA4APL, 6521 Creekstone Place, Charlotte NC 28213. BNB723

MORSE CODE GENERATOR for PC/AT or compatible clones. All speeds from 1 to 35 wpm, 7 tones. Data for 720 minutes of copy at 10 wpm and file utilities supplied at no additional charge. $12, $2 s&h. Tax 7%, Dallas area 8%; RAMTRONICS, 1809 Chamberlain Dr., Carrollton TX 75007. BNB724

Say you saw it in 73!

73 INTERNATIONAL

edited by Richard Phenix

Notes From FN42

April brings such important celebrations to so many that, although religious, they demand listing here.

On the 1st: Hanuman Jayanti (Hindu—Hanuman is a guardian spirit, helper of Rama); Passover (Jewish) begins on the 2nd; Easter (Christian) is on Sunday the 3rd (10th for Orthodox); Buddha's birthday is on the 8th (Buddhism); and Ramadan, the month of fasting (*sawm*—the Fourth Pillar of Islam) begins on the 18th.

Happy New Year on the 14th, Bangladesh! And Happy Birthday to the Queen (Denmark on the 16th and the 30th for the Netherlands) and to the King (Sweden on the 30th), and to the Emperor of Japan on the 29th.

Other days: 1—Youth Day, Benin; 4—Independence Day, Senegal (and on the 18th for Zimbabwe) and it is Liberation Day, Hungary (and on the 25th for both Italy and Portugal); 5—Arbor Day, South Korea; 6—Victory Day, Ethiopia (on the 24th for Togo); 7—World Health Day, and Woman's Day in Mozambique; 11—National Heroes Day, Costa Rica; 12—National Redemption Day, Liberia; 13—National Day, Chad (and on the 27th for Afghanistan), 14—Pan American Day; 15—Military Regime Anniversary, Niger; 17—Evacuation Day, Syria; and in the U.S., Secretaries Week begins; 19—Republic Day, Sierra Leone; 23—St. Georges Day, U.K.; 25—Anzac Day, Australia and New Zealand; 26—Union Day in Tanzania. And Happy 197th Birthday on the 27th, Mr. Samuel F. B. —— ——— .—. ... .!

Roundup

New arrangements for our correspondents. The wider the world coverage in *73* International, the less space available to any one report.

It's unfair to ask correspondents for material and then use little or none of it. Beginning with the June issue, therefore, any ham, a citizen of his (her) country, may be given by *73* the title of foreign correspondent (one per country, with exceptions) and a year's subscription in return for sending to this column three reports yearly. Present correspondents can, of course, continue under the new arrangement. *73* encourages all to send in the kinds of reports seen here, but now submit them for possible purchase, for consideration along with all other non-*73* International material.

The three annual reports should concentrate on short items on hamming in the correspondent's country: exciting happenings (to readers in the U.S. and around the world), new technological developments (packet, for example), new and changed regulations, and special events.

Do not submit to this column, however, detailed contest information. *73* International will announce new contests, but details, and results—unless spectacular—should be sent for publication where contesting is a bigger subject for reporting.

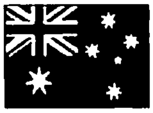
73 International invites comments on this new plan. The column also welcomes input on what the readers want to see and don't, and what they *do* see and *don't* want.

Universal Permit Application. *(Refer to January issue, p.78.)* More changes, deletions, and comments next month, but see permit information in national reports, below.

Ireland. Baile Atha Cliath celebrates its "One Thousand Years as a City" during 1988. *[That's Dublin.—Ed.]* The Special Event Station EI1000 rung in the new year; plans for St. Patrick's Day: the ambitious attempt to make contact with all the Dublins around the world (some 20 of them) on SSB and some pre-arranged SSTV (a first for amateur radio). EI1000 will be active on all bands and modes all day. Then, on the Millennium Birthday (July 10) EI1000 will be active again. One can receive a special QSL card through the Irish Radio Transmitters Society bureau or direct upon receipt of three IRCs. (From the *IRTS Newsletter* for December 1987.)

CHINA ADDRESSES
(PO Box and City)

BY1PK	6106	Beijing
BY1OH	2654	Beijing
BY1SK	2916	Beijing
BY1CJK	6206	Beijing
BY4AA	205	Shanghai
BY4AG	5304	Shanghai
BY4AOM	227	Shanghai
BY4RN	2405	Nanjing
BY4RB	413	Zhen Jiang
BY4SZ	51	Suzhou
BY4WNG	1827	Nanjing
BY5RA	730	Fuzhou
BY5RF	209	Fuzhoo
BY5QA	507	Fuzhou
BY5HZ	804	Hangchow
BY5RT	707	Fuzhou
BY7KT	1285	Guangzhou
BY7HL	105	Changsha
BY8AA	607	Chengdu
BY8AC	607	Chengdu
BY9GA	12	Lanzhou (Gansu Province)
BY0AA	202	Wulumuchi (Xinjiang)



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

Australia celebrates its bicentenary in 1988 and special celebrations are planned for all States. The two largest are a re-enactment of Captain Cook's landing in VK2 (Sydney) when Tall Ships from many nations, led by a replica of Cook's *Endeavour*, arrive after a 12,000 mile re-enactment journey from England; and the 1988 World Exposition, in Brisbane (VK4), from April to October. Amateurs will have a special station within the Expo complex.

Antennas for all bands and modes have already been approved. The call (pity the poor CW op) will be VI88EXPO. The station will provide the public with an insight into amateur radio, and be a meeting place (eyeball or via the waves) for hams. QSLs via the bureau should be no problem, since the Expo authorities have agreed to provide 200,000 QSL cards.

Special callsigns, pending clearance with the ITU, will be VI88A through VI88Z. This I learned from the DOC (now the DOTC, for Department of *Transport* Communications, since it combined with the Ministry of Transport). The thought sprang to my mind as the switchboard girl answered with the new name, "10-4 good buddy, we've got a convoy."

VK7 Tourist Information is a pleasing addition to the scene, accompanying the upsurge of tourism in Tasmania. The efforts of VK7NGH (Greg) and VK7OL (Owen) have been much appreciated by both VK and overseas amateurs. Owen is the official handshaker at the Tasmanian Ferry Terminal (for ferries arriving at Devenport from Melbourne (VK3)). The reception usually includes an invite home for a cup of tea with Owen and his wife. He and Greg (and also John VK7JK, the editor of the local VK7 WIA newsletter) are always willing inform newcomers about places to visit in Tasmania. It always pays to write beforehand to give them a chance to organize a timetable. *[Always do this!—Ed.]* Reach them at the following: Owen Lanchan, 4 Lynd Court, Devenport 7310, Australia, phone: 004-243010; Greg Honey, 63 Mirramar Park, Blackman's Bay 7052, Australia; and John Rogers, 1 Darville Court, Blackman's Bay 7052, Australia, phone: 002-293402.

John says, "If you wish to pat the local Tasmanian Devil during your visit, please bring your own fingers."

Marine Mobile amateurs traveling to Australia should get a 1986 DOTC guide. They should also know of this statement:

Please note that when an amateur station is licenced outside Australia, and is installed and operated from a vessel registered in another country, an additional Australian licence is not required when the station is operating within Australian Territorial waters. This applies so long as the station remains an integral part of the vessel. Operation of the station, however, must conform with Australian regulations. Amateurs require permission to operate and should first establish the conditions with which they must comply before any transmissions are made in Australian waters.

HONG KONG

Phil Weaver VS6CT
10A Bonaventure House
91 Leighton Road
Hong Kong

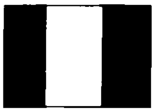
1987 In Review—Part 1 of 2.

The big step this year has been in Packet Radio. Brett Graham VS6UP sparked growth to the current 50 stations. Also, Asia is about to embark on a NET/ROM system using 29.010 MHz. Currently in Hong Kong we operate a digipeater on 144.25 MHz, and the HF gateways are VS6UP on 14.107 MHz, VS6EL on 14.109, VS6UF/1 on 21.099, and VS6UP/2 on 29.010 MHz.

I am currently in charge of the Port Communications Center of

the Maritime Department in Hong Kong, and welcome visitors interested in our Port Control Center and Maritime Rescue Coordination Center. We cover all of the South China Sea. We have HF, SSB, telex, AFTN and facsimile.

I have regular schedules with BY1QH Saturdays at 0530Z on 14.130 MHz, and after reading the very good article on amateur radio in China *[January issue, Chang Han Dong, on p. 94—Ed.]* I wondered, how do you get a QSL card from China? I asked Yuan Bo, and he advises that QSL cards can be sent *into* China care of BY1PK for distribution but they have no funds or machinery to operate an outward bureau. I have, therefore, put together an up-to-date and complete list of stations currently operating in China and recommend you send the card direct to the station concerned. (See box, page 98.)



ITALY

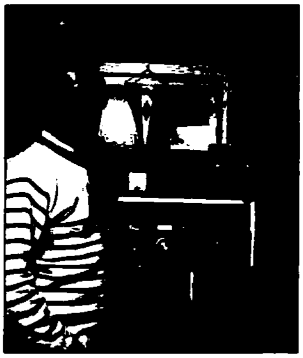
Giancarlo Martelli I0XXR
Via A. Bevignani, 18
00162 Rome
Italy

[Welcome back, I0XXR! The last report from Italy written specifically for us was from I2MQP (February 1986).

I0XXR was licensed in 1946 and was I1PL until 1955, but he was very active in 1938–1940 as a boy when it was illegal in Italy. The Fascist government, however, tolerated it. He wrote last for us for the August 1984 issue! —Ed.]

Some will remember I wrote last about the "80-meter affair," in Italy. It was an ugly story about Italian hams being confined to the two thin slices, 3613-3627 and 3647-3667 kHz, so that the CW and RTTY portions could not be used, and the SSB DX window close to 3800 was forbidden as well. This was an old, old rule and gradually nobody paid attention to it—hams and authorities alike. "Don't wake the sleeping dog," says an old Italian proverb, and hams tried to be silent about it and QSYed from 3.5 to 3.8 just as hams in other countries were doing legally.

Then, about five years ago, there was suddenly a shower of heavy fines and license suspensions on hams monitored outside the permitted slices. Our anger



I0XXR in his QTH with TS-830S and backup FT-101E. Antenna is TH3 for the HF bands and a quad loop zepp fed for the LF bands.

and disappointment was great and a very strong opposition started against that governmental policy by many, including ARI (Associazione Radioamatori Italiani). After much pressure, letters to newspapers, talks with politicians, debates, the truth emerged. A very long time ago the Defense Ministry had registered with the International Radio Frequency Board in Geneva over a hundred frequencies in the 80m band for itself and possible military use.

As we explained to ministry officials about the 3.5–3.8 WARC recommendations for shared frequencies (amateurs, fixed, and mobile), we discovered that the policy had been born out of armchair discussions. For years, ministry officials believed that their registered frequencies had been frozen for them alone and that they had been kept clear from any kind of traffic!

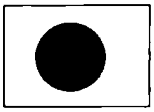
Finally, on December 14, the Ministero delle Poste e Telecomunicazioni informed ARI that 3.500 to 3.800 was opened to the Italian Amateurs Service on a Seconday Status. According to WARC, amateurs should be Primary on this band, but we don't bother too much about the small limitation. Who can feel "Primary" in competition with a 25 or 50 kW RTTY commercial or government station?

Years ago, our law was one of the most limiting. The VHF and UHF repeaters were illegal, no mobile traffic was permitted, the maximum legal input power was 300 Watts (and still is), but many things have been changed, and many others are going to change!

ALIEN AMATEUR PRIVILEGES IN JAPAN

License Class					Japanese
Australia	Canada	W. Germany	France	US	Permit Class
Unrestricted	Advanced	B	E	Extra	1st[1]
	Digital				Limited 1st[2]
			D	Adv. and Gen.	2nd[3]
			C		Limited 2nd[4]
Novice	Amateur	A	B	Tech.	Telegraph[5]
				Novice	Limit.Teleg[6]
Limited		C	A		Telephone[7]

1. All modes, all bands, 500W max.
2. All modes, all bands above 30 MHz, 500W max.
3. All modes, all bands, 100W max.
4. All modes, all bands above 30 MHz, 100W max.
5. All modes, all bands except 10 and 14 MHz, 10W max.
6. A1A and A1B mode cnly, on 3.5, 3.8, 7, 21, 28 MHz, 10W max.
7. All modes but A1A, A1B, all bands but 10, 14 MHz, 10W max.



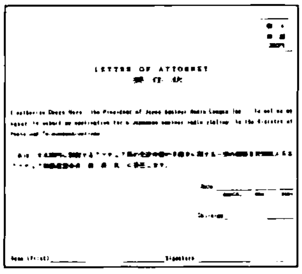
JAPAN

The Japan Amateur Radio League, Inc.
International Section
14-2, Sugamo 1-chome
Toshima-ku, Tokyo 170
Japan

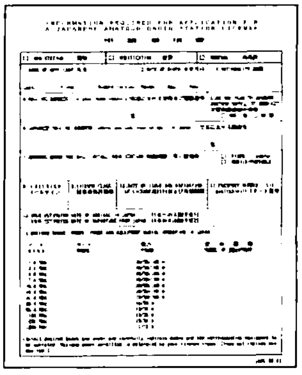
[Applying for permit to operate is complicated, but it is efficiently described. 73 International will not now try to incorporate the Japanese procedure into the development of the Universal form. If a reader wishes to use the two forms reproduced here, complete with Japanese language, send 73 an SASE with your request for copies—Ed.] Submit to the above address the completed application and "Letter of Attorney" forms 60 days before beginning transmitting in Japan. Also send photocopies of the photo page of the passport (or equivalent proof of citizenship) and the current amateur radio license, and payment as specified below (or as proof of payment, a copy of the bank transfer document). The permit will be valid for one year or until your current license expires, whichever is less. (Five year permits for alien permanent residents will be granted upon proof of this status.)

It's recommended to request a portable 50-watt station for use anywhere in Japan—see item 13 on application form. (A separate license and an additional fee is charged for fixed station operation in addition to the portable 50-watt-or-less station.) Fees: 10-watt station or less (mobile/portable)—10,000 yen; over 10 to 50 watts (mobile/portable)—13,000 yen; over 50 to 100 watts (fixed only)—19,000 yen. *[Figure 125 yen to the dollar just to estimate costs, but use official exchange amount when making payment by International Money Order to JARL with application, or by bank transfer to the JARL account (# 061-9003391) at the Komagome Branch, Mitsubishi Bank, Tokyo, marked "For reciprocal amateur radio license." —Ed.]* If planning to run over 100 Watts output, write for special permit process. This could take over three months to arrange.

A license will be forwarded to the applicant's address in Japan (line 6 on the application form). If he prefers, he may choose a mobile/portable station, put the JARL address on line 7, and mark on line 6, "Hold license at JARL." In this case, pick up the license at JARL by presenting passport or other such ID.



LETTER OF ATTORNEY



These forms for Japan may be obtained from 73 International by sending a #10 SASE with your request.

LIBERIA

Kamal T. Hamzi EL2AY
c/o Carol McClure N5GAP
3428 Kilrush Drive
Arlington TX 76014

[Liberia appeared here last in April 1986, when Don EL2AL moved away. Perhaps EL2AY will become the new Liberian correspondent? This is our invitation to him.

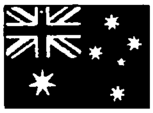
73 is pleased to learn that Kamal met with great hospitality while he was in this country. He wrote his appreciation with such emphasis, that duplications were edited out to save space!—Ed.]

Every Sunday night but one since I returned I have had a 2100Z schedule on 14200 with my friend Norris Gaynor KA2QWZ—a friendship which started with a single QSO a few days before I left for the USA. The one exception, he arranged for his friend Neda PT7WY to fill in and to present his regrets. His family invited me and my friend Issa to their home in Pine Grove, and from them, including the nine-year-old daughter, Melissa, we received the kind of warm hospitality one associates with close family members. I used his station to contact Abdullah EL2CE who called my wife to report my safe arrival. The Gaynors arranged also for a luxurious fruit basket to greet us at our hotel.

At Harrisburg I was met by Maryann WA3HUP, QSL Manager for JY1 and 67 other hams all over the world, and her son Gary. It was sheer pleasure to finally meet her after years of talking with her. We visited a mutual friend, Ruth WB3CQN, and I wished I didn't have to fly on to Boston, where I was met by my Liberian friend Jerome Bowen, at whose brother's (Brunei's) house I spent the night. His wife, Virginia, took me shopping the next day.

In Dallas I was met by my QSL Manager, Carol N5GAP, well known to the Liberian Radio Amateur Association. She is Stateside Net Control for the Liberian-African Queen Net every Monday. She had cancelled my hotel reservation and insisted I stay with her family in Arlington. Here I went through a stack of correspondence, my QSL mail, and the A-8 QSL contribution cards for the Ganta Leprosy Center. Carol is in charge of collecting all A-8 contributions. Carol told me to make myself at home in her radio shack, and I made contact with EL2CE and EL2EN in Monrovia. It was hard to leave to fly home, but Carol promised to visit Liberia for our 25th Anniversary celebrations.

Generosity had not ended yet. On the flight home I had an animated conversation with a Massachusetts journalist writing for the *Martha Vineyard Gazette*. I still receive courtesy copies of this newspaper!



NORFOLK ISLAND

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island, 2899
Australia

Last July, amateur radio played a role in an emergency at sea near Norfolk Island.

It all started on the maritime mobile net on 14.315 MHz, where John Anderson VK9JA reports daily, keeping yachts at sea informed of weather conditions in the area.

The San Diego-registered yacht, *Heather Marie*, was nine days out of Aukland, New Zealand, when she sailed into heavy weather in the Tasman Sea. On board were four people, one of whom had been taken ill and suffered severe dehydration. The skipper, New Zealand-born Patrick Waddick KB6GKS, knew that the ill crew member had only half a kidney, and so decided to head for the nearest land.

The yacht was already on a course for Norfolk Island. The crew had decided earlier to have a look at the Island on their way to Australia, but from a safe distance. Two yachts had already come to grief this year while at anchor off Norfolk, which has no safe harbor.

In trying to increase speed, the skipper ran too much canvas, resulting in a torn mainsail and damaged rigging. In worsening weather, he reported his plight to the maritime mobile net.

John VK9JA was aware of the yacht and of the ill man on board. They sought and obtained medical advice from the Norfolk Island hospital via John, and began to feed the patient sweetened water to slow down dehydration. With the damaged rigging and sails, however, the situation became more urgent. It was time for a sea rescue. Norfolk Island does not have any facilities for rescues at sea. Motorized fishing vessels go out when weather permits. They are small open craft usually remaining within sight of the Island.

John contacted the local authorities, who in turn got in touch with Sea Safety in Canberra, Australia. Sea Safety unsuccessfully tried to raise assistance from other ships in a radius of 100–300 miles. Norfolk Island is, after all, on the way to nowhere—far from normal shipping lanes. They finally sought assistance from the Royal Australian Navy.

As luck would have it, the *HMS Whyalla* happened to be in a position about 100 miles west of Lord Howe Island, which placed her some 600 miles from Norfolk. As the *Whyalla* sped towards the *Heather Marie*, John stayed with his rig, monitoring and relaying all messages.

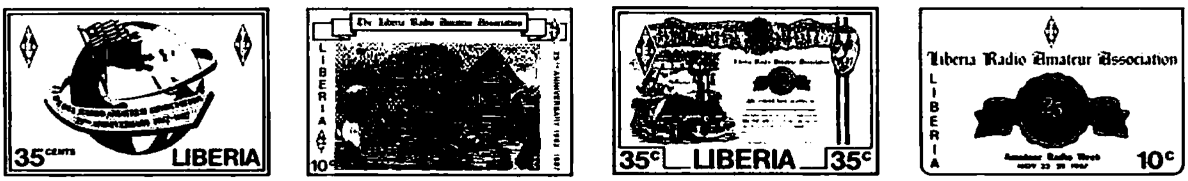
When radio conditions failed from time to time, other amateurs on the frequency were able to relay. The Norfolk Island Police became the local authority in charge, and John now made his home available to the Police as operations center. Hourly position reports were required from the yacht. Thanks to satellite navigation equipment on board, this presented no problems. A couple of small planes visiting the Island at the time, also made a few runs out to the yacht to confirm positions already relayed via amateur radio.

All traffic was conducted on the amateur radio bands. The *Whyalla* also had access to the emergency frequency in use with her skipper operating. Although Norfolk Island has a Coastal Radio Station, it's of fairly limited use and manned only for contacting the regular supply ship. In this case, it was of no use as the yacht had only amateur radio on board and the coastal radio is not equipped for these bands.

After a 29-hour high-speed run, the *HMS Whyalla* finally sighted the yacht on July 27 at approximately 3:30 p.m. The *HMS Whyalla* took the yacht in tow and brought it to the relative safety of Cascade Bay, Norfolk Island. The sick crew member spent a night in the hospital before flying home to his own doctor in the U.S.A. After some repairs to the yacht, the skipper set course for Australia once more.

After a 48-hour vigil at the radio, during which John had hardly slept, the first-ever amateur radio/sea-rescue operation involving Norfolk Island was thus successfully concluded. The local police and other authorities praised John for his excellent conduct on the communications side of the operation.

To quote the senior Sergeant, "John's expertise and experience with the radio were invaluable to the authorities throughout the whole operation. It appears that in John's case, the term 'ham operator' seems rather inadequate."



Liberian Commemorative Stamps

Liberia has just issued a set of four colorful stamps commemorating the 25th anniversary of the Liberian Radio Amateur Association. Jim DeLoach EL2GA/KB6EH reports that Liberian hams are now using these stamps for their correspondence.

QTH DX

Number 36 on your Feedback card

QTH is Pitcairn Island

Leon Fletcher N6HYK
274 Webster Dr.
Ben Lomond CA 95005

Isle of Intrigue

In some select circles, a person hasn't really traveled until they've visited Bang on Iron, Goat House, Down Under Johnnie Fall, and No Guts Captain.

Still, they do earn two points if they recognize those names as key locations on the fascinating DXCC country of Pitcairn Island—VR6.

But unusual place names are not the only strange and largely unknown facts about Pitcairn.

Mutiny on the Bounty

Many people know that mutineers from *His Majesty's Ship Bounty* settled Pitcairn. She was a 100 foot, three-masted, armed merchantship. The crew's mission was to sail from England to Tahiti, barter for breadfruit trees, and deliver them to British colonies in the West Indies to provide food for slaves.

The mate, Fletcher Christian, and other crew members took over the ship and aborted that mission. The mutineers put the deposed captain William Bligh and eighteen of his crew in the ship's small boat and set them adrift. Most eventually reached England.

The rebels sailed the Bounty back to Tahiti to continue the fabulous partying they'd started there earlier.

Beyond these basic facts, however, what most folks know about the mutineers comes from Clark Gable's portrayal of Fletcher Christian in the 1935 film, *Mutiny on the Bounty*, and from Marlon Brando's role as Christian in a second film version, in 1962.

Unfortunately, both those films are packed with errors. Probably the most extreme error was the depiction in Brando's film of Christian dying on a Pitcairn Island beach. There isn't a beach on the island, and Christian died in a field of yams, fatally shot by oppressed Tahitian men. According to Ian M. Ball's 1973 book *Pitcairn: Children of Mutiny*, however, even today's descendents of the mutineers "accept (those faulty films) as gospel."

People also incorrectly assume the mutineers were the first people to inhabit Pitcairn. Actually, Polynesians lived there centuries earlier. Rock carvings, human burial sites, earth ovens, and other artifacts on the island show this. Indeed, the mutineers were not even the first Europeans to sight the island. In 1767, 23 years before Christian and his gang arrived, English Captain Philip Carteret, in command of *His Majesty's Ship Swallow*, sailed by, but didn't land because—as he noted in his ship's log—"the surf broke upon (the island) with great violence."

Despite the landing hazard, the mutineers settled on the island in 1790—"almost in desperation," according to a government booklet about the island—after two months sailing in search of a safe hideout.

Dangerous Ground

The mutineers made a poor choice. The island is only about two miles long and one mile wide. It covers approximately 1,120 acres—less territory than the Rock of Gibraltar. The only access is through a boulder-strewn cove on which heavy seas pound almost continually. Nearly vertical cliffs 300' and higher surround the rest of the island.

To get on and off the island, the settlers built distinctive 36' longboats, which they learned to work in and out of the cove—by oar, of course. Diesel engines later replaced oars as the main propulsion for these boats, but they are still the only means of landing on the island. To make boat-handling easier, the British Navy built a concrete jetty in the mid-1970s.

Far from Everywhere

Pitcairn is located roughly halfway between the United States and New Zealand. The nearest commercial port is some 1,350 miles east and slightly south of Papeete, Tahiti.

Another myth abounds that today's Pitcairn is the home base for descendents of the mutineers. Actually, fewer than *three* percent of the rebel's descendents live on Pitcairn. Worldwide, there are some 1,500 descendents. Nearly half live on Norfolk Island, a possession of Australia located 3,700 miles to the east. Nearly 400 descendants live in Australia, 160 in New Zealand, and 150 on Tahiti and other French Polynesian islands.

Figure 1. The author's QSL card from Pitcairn Island's most prominent ham, Tom Christian VR6TC.

Tom Christian VR6TC, the Radio Officer, is the most famous radio communicator on the island. Many hams have worked Tom. This position pays Tom to handle official and personal traffic mostly through a commercial station in Suva, Fiji.

Tom is a sixth generation descendent of the original leader, Fletcher Christian. Tom is six feet, two inches tall, trim, and in his early fifties.

Tom's wife, Betty, operates as VR6YL. Irma Christian—a relative of course—is licensed as VR6ID. Then there's Kari Young VR6KY, one of the few outsiders to join the Pitcairn community. When she was a teenager in her native Norway, she read the 1932 book *Mutiny on the Bounty*, by Charles Nordhoff and James Norman Hall. This book also expounded many myths for it was meant to be fiction, yet it fascinated Kari. She thus studied to be a ship's radio operator, went to sea, reached Pitcairn Island, and settled in.

Isolated

Many people also mistakenly believe that ships often visit the island. Years ago, several ships a week visited Pitcairn, but now only about two vessels a month stop by. Thus, for Pitcairners, radio is now more important than ever.

Radio first arrived on Pitcairn in 1922, in the form of a donated crystal receiver from the Marconi Company. A small coil transmitter that a New Zealander gave to the community sent the first radio transmissions from the island in 1926. Two Americans installed transmitting and receiving gear paid for by private contributions in 1938. In 1940, the New Zealand Navy built shortwave facilities, providing the first regular link with the outer world.

Radio, however, is nearly the only modern convenience on the island. Most residents live in unpainted, ramshackle houses built from lumber thrown overboard from passing ships. There is little furniture. Kitchens have dirt floors and stone ovens.

Yet there is some modernization. The nearly 30-year-old bulldozer used in building the jetty remains on the island. The islanders occasionally use this tired old beast to rehabilitate the dirt path running from the landing to the homes 300 feet above and to help move cargo. There are several dozen motorcycles and a few 3-wheel all-terrain vehicles. There are now even a few VCRs on the island, showing tapes that hams around the world sent to the islanders! They also have a video camera.

Only 28 souls constituted the original group that settled on Pitcairn—nine mutineers, six Tahitian men, 12 Tahitian women, and an infant girl. This original group spawned large families—the population peaked in 1937 at 223 residents. Today, however, there are only 40 people on Pitcairn, which causes grave concerns for the future of the island.

As the number of residents dwindles, some observers say that the end of the community is in sight. According to *National Geographic* writer Ed Howard, in a 1983 article about his visit to the island, "If only a few more (residents) leave Pitcairn, it may not be possible to man the longboats and make contact with the few passing ships." Indeed, some recent visitors to the island claim that even Tom Christian says he would like to leave Pitcairn. Others report he's been saying that since at least the early 1970s.

Number 37 on your Feedback card

OP-ED

by Larry Ledlow, Jr. NA5E

Good Morning, Class!

Oh, how I used to dread school. The prospect of another day of ABCs or other tedious exercise hardly motivated me to drag my lazy buns out of bed. The real motivator was my mother's recipe for rise-and-shine, which she very deftly applied with the palm of her right hand. Ugh!

"The ham industry devotes a great deal of rhetoric (and darned little else) to recruiting young hams into the hobby."

School days were either feast or famine, intellectually speaking. I can still recall the countless sessions reciting addition tables in harmony with two dozen other children. Or the ocean of tiny bodies hunkered down with giant pencils and Big Chief tablets, our tongues positioned for maximum concentration, while we made miles of graphite loops between the lines on the paper. I would ask myself if there really was intelligent life beyond second grade. Better yet, the history lessons, staring at datelines, maps, and family trees hoping to burn the images onto my retina for easy recall on the next exam.

You, too, eh?

Sweet Memories

Ah, but who remembers the taste of paste? How about feeding the gerbils? Then the chemistry experiments, making that bookcase in wood shop, or the field trip to the candy factory? THOSE were the feast days, those memorable interludes from the humdrum of rote learning. Those special days and events actually meant something. They were diverse sensory experiences. I got my hands dirty, created something tangible—I used something more than a book or the blah-blah-blah lectures to learn something new. All of the truly memorable experiences in school were FUN!

Thank goodness for innovative teachers and understanding administrators, who successfully promote fun and meaningful learning experiences. But, alas, the opportunities to explore creative teaching and learning are few and far between, especially in our nation's public school systems.

Nonetheless, there are a few shining lights in the darkened halls of academic endeavors. Take a look at Peter Kemp's BEARS project in this issue. Carole Perry WB2MGP of the New York City school system is another innovative instructor you'll read about in an upcoming issue. And a handful more teacher-hams recognize amateur radio as something more than an end in itself.

They view this great and varied hobby of ours as an effective teaching tool. They use amateur radio as a means to get the students involved with the subject at hand: science, geography, government, foreign languages, civics, mathematics, and so on. The student and faculty responses have been overwhelming. Amateur radio's use in the classroom to teach a variety of subjects *works*. Full stop. It's fun for both students and teachers, and amateur radio gains some respect amongst non-hams.

The ham industry devotes a great deal of rhetoric (and darned little else) to recruiting young hams into the hobby. Is there a better way to expose the public at large to amateur radio than in the school system? Students, parents, teachers, and administrators—most of us fit into at least one of those categories—would all be exposed to amateur radio! Further, it doesn't have to be limited to high school or elementary grades. Why not extend the concept to college or adult continuing education programs?

Just the Beginning

OK, suppose we all agree that ham radio would succeed as a teaching tool. Big deal. That's the easy part. We have to successfully pitch the idea to hundreds of thousands of non-ham teachers and school board members. THAT could be a problem, but not if we're smart about the sales job.

First, we need to find the sympathizers amongst the teachers. By highlighting successful programs already in progress around the country, the industry is bound to win over quite a few converts. After all, a lot of the teachers are just as tired of the routine exercises as the students. With data on current programs, the next step would present the pros, cons, and hard facts to the National Education Association (NEA) and other teachers' organizations at national and regional conventions.

An important point: Sympathetic educators who believe in the potential of ham radio in the classroom would have to make the actual presentation. I seriously doubt the NEA or other educational groups would view a ham industry pitch as anything other than a commercial venture. That doesn't mean the industry can't support Educators for Amateur Radio, however. For that matter, all of hamdom should support such a group to give the hobby a great shot in the arm.

Why not team up with other organizations with similar goals? For example, the Institute of Electrical and Electronics Engineers (IEEE) is especially concerned about the dwindling number of engineering students in America. Certainly amateur radio programs in schools would interest many students in electronics technology. Hence, a common interest between the IEEE and the ham industry.

A plan well thought out and properly executed between national organizations would carry a lot more weight than a call to arms on editorial pages of the ham magazines.

You're probably saying, "Yeah, sure. This is just a lot more rhetoric. Nothing will ever happen." Why not? There's a lot of inertia to overcome, but with a few shakers and movers, we can get things rolling.

Volunteers, please step forward!

The Tax Man Cometh

Speaking of education, like a lot of other folks this year, I am learning about the new tax laws that took effect on January first. There's nothing quite like staring down the barrel of a 1040 long form aimed squarely at my pocket book to make me read the fine print.

Our politicians, in their infinite wisdom, have decided employer-paid education benefits are now taxable! Yessir, all tuition-assistance benefits to US employees are subject to Federal income tax and Social Security withholdings. Imagine getting your employer to pay for a few evening courses you need for the next promotion, then finding your tax bill increased by another $500!

The impact is potentially disasterous on advanced engineering and technical education in this country. After all, many technical graduates, until now, have pursued after-hours degree programs sponsored largely by their employers. With education benefits taxable, some employees can no longer afford school, thus putting an end to their academic careers. Obviously, Congress no longer feels education is of paramount importance in our society. This does not bode well for the future of America.

"Congress no longer feels education is of paramount importance."

Uncle Sam has just taxed our efforts to improve ourselves. (Wouldn't it make more sense to tax the uneducated?) Warm up your pencils and word processors and encourage your representatives in Washington to make tuition assistance untaxable again. We'll all be better for it. ■

73 AMATEUR RADIO

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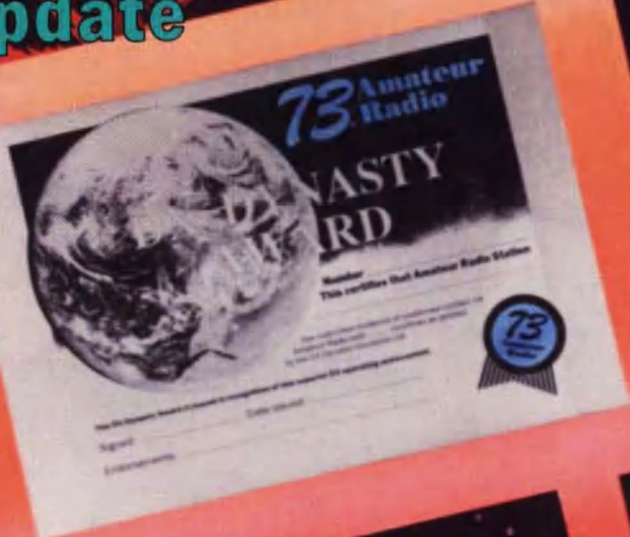

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Number 1 on your Feedback card

Welcome Newcomers!

Out Of This World, But...

John Q. Public is becoming more and more aware of those man-made objects orbiting the Earth hundreds of miles up. They have a growing variety of uses. They **downlink** satellite TV signals to Earth, highly detailed images of military installations, and weather pattern images over given areas of the Earth—to name a few.

Despite their growing presence, however, John may see satellites as arcane beasts. He may believe that only white lab-coated scientists, working in the rarified air of military and commercial high-tech R&D, can understand the function and behavior of these high-flying **birds**. How can the common man, without years of training in space technology, have any hands-on experience with satellites?

Answer: Through hamsats—satellites built by the Amateur Radio Service.

Well Within Your Reach!

The amateur radio service world-wide has, in the past 26 years, sent a series of hamsats into orbit, a half dozen of which are presently fully functional. Hamsats contain **transponders**, devices that receive signals from Earth, amplify them, and transmit them back towards Earth. Thus, John can—with the appropriate amateur license, or under the supervision of an amateur licensee—*communicate* through a hamsat with someone up to halfway around the world!

Although the typical ham neophyte doesn't immediately launch into satellite operation, it's not a difficult next step.

Evolution of Hamsats

The first hamsat, **OSCAR 1**, flew in 1962. This was indeed a humble craft—several hams built this 10-pound bird in their homes using less than $70 worth of parts! It "hitched" a ride into orbit in a spare compartment on a rocket carrying a payload for the Air Force. This bird and the next (OSCAR 2) carried only a **beacon** that repeatedly sent the message "Hi" in Morse code back to the Earth. OSCAR 3, the first hamsat to carry a transponder, went up in 1965, allowing nearly 100 hams in 22 countries to make contacts through it.

The amateur community was entranced by their new presence in space. The small group of hams behind the first hamsats—Project OSCAR—swelled, and new groups of hams formed to build and put hamsats into space. Hamsats rapidly became more sophisticated (see sidebar). AMSAT (The Radio Amateur Satellite Corporation), an East Coast version of Project OSCAR, formed in 1969 in Washington, DC. These two groups soon spawned associated AMSAT organizations in the US, UK, Canada, Germany, Australia, and Japan, all of whom have at least assisted in OSCAR construction and launching.

The Soviet Union also has a very successful amateur satellite program. They began launching the Radio Sputnik (RS) series in 1978. RS-10/11, a single hamsat containing two transponders, is currently very popular.

The glossary contains terms not only printed in bold in this column, but also commonly-used terms the reader will encounter in the satellite features in this issue. See you on the birds. ■ ...de KA1HY/AE

AMSAT-OSCAR Phases

This are currently three of these. There are a few expections. Read *The History of Project OSCAR* in this issue for more details.

Phase 1 – This phase includes OSCARs 1–5. These hamsats were low-Earth orbiters and did not have rechargeable batteries.

Phase 2 – OSCARs 6–9, and 11 are Phase 2 birds. These birds are still low-Earth orbiters, but contain rechargeable batteries to give them long operating lives, sometimes years. Solar panels on the hamsat surface recharge the batteries.

Phase 3 – OSCAR 10 is the second and only operational Phase 3 bird. Phase 3A was destroyed when its Ariane rocket failed in flight. Phase 3C is scheduled for launch in late May. This hamsat has rechargeable batteries and a highly elliptical orbit. Its apogee can be as high as 23,000 km (14,400 mi). Earth stations can often operate for many hours through OSCAR 10 during a single pass.

Phase 4 – This is a dramatic step, planned for the 1990s. Phase 4 birds will be geosynchronous, like many current commercial satellites. Stations within their windows will always remain there, and so will have permanent access to the satellites with little or no tracking required.

GLOSSARY

AOS – Acquisition Of Signal. This is when a satellite reaches a point in its orbit when a given Earth station begins receiving signals from it. This occurs usually when the Earth station and the satellite become line-of-sight. This conventionally marks the beginning of a satellite pass.

Apogee – The most distant point from Earth in a satellite's orbit. Satellites with high-apogee orbits "view" more of the Earth's surface, thus allowing more distant stations to contact each other through it.

Azimuth – The direction measured in degrees clockwise from true north around a circular arc along the horizon.

Beacon – A transmitter aboard a satellite that sends an identification or tracking signal.

Bird – Satellite-chasers' jargon for satellite.

Doppler Effect – The variation of the frequency of a downlink signal according to the the speed of a satellite approaching (or receding from) the Earth.

Downlink – Refers to the signal traveling from the satellite to the Earth station.

Elevation – This is the angle between the horizon line and a point in the sky. A 90-degree elevation angle refers to a point directly above the observer, also called zenith.

Geostationary – A geostationary satellite orbits the Earth at the same rate that the Earth rotates on its axis. Because of this, the satellite appears to remain over the same point on the Earth's surface. Satellites 22,300 miles above the Earth are in geostationary or geosynchronous orbits.

Inclination – The angle between the plane of the satellite orbit and the Earth's equatorial plane.

Keplerian Elements – The set of six parameters needed to accurately calculate any satellite's orbit. These parameters are called right ascension at ascending node (RA), argument of perigee, eccentricity, inclination, mean anomaly, and mean motion. If the orbit is circular, only four parameters are needed for orbit predictions. All parameters must be referenced to the same epoch (time and dale). These allow a satellite-chaser to calculate the azimuth bearing and elevation of a given satellite at a given time. There are many computer programs available that can perform this calculation.

LOS – Loss of Signal. This is when a satellite reaches a point in its orbit when a given Earth station loses its signal. This conventionally marks the end of a satellite pass.

Low-Earth orbiters – These satellites have a more circular orbit around the Earth than do high-apogee satellites. They orbit 200–3000 km (120–1875 mi) above the Earth. A typical direct-overhead pass for these birds lasts only 10 or 20 minutes.

OSCAR – Orbiting Satellite Carrying Amateur Radio. Refers to the AMSAT-OSCAR birds.

Parabolic antenna – Also known as a dish antenna. The concave side of the dish receives and collects signals. It is so shaped so that signals striking any part of the dish will reflect to the same point, which are collected by a feed horn and routed to the receiving station. These antennas are extremely efficient signal-gatherers for frequencies above 500 MHz.

Period – The time it takes a satellite to make one complete revolution around the Earth.

Telemetry – Radio signals originating at a satellite that convey information on the performance of onboard systems such as temperature, and whether or not the transponder(s) is/are operational.

Transponder – A device on board the satellite that receives a signal from Earth, amplifies it, and transmits back to Earth on another frequency, usually in another frequency range.

Uplink – Refers to the signal from the Earth station to the satellite.

Window – The area within which two or more Earth stations can access the same satellite, and so communicate with each other.

STAFF

PUBLISHER
Wayne Green W2NSD/1

ASSOCIATE PUBLISHER
Stuart Norwood

EDITOR-IN-CHIEF
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SENIOR EDITOR
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Rodney Bell

TYPESETTING/PAGINATION
Bob Dukette, Systems Supervisor
Steve Jewett KA1MPM, Linda Drew, Susan Allen

GRAPHICS SERVICES
Richard Clarke, Manager
Sue B Flanagan, Jodi Johnson, Dale Williams

GRAPHICS PHOTOGRAPHER
Dan Croteau

Editorial Offices
WGE Center
Peterborough, NH 03458-1194
803-525-4201

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73 AMATEUR RADIO

MAY 1988 Issue # 332

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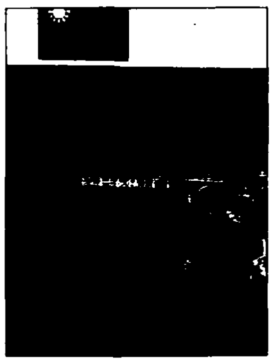
FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 89. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.



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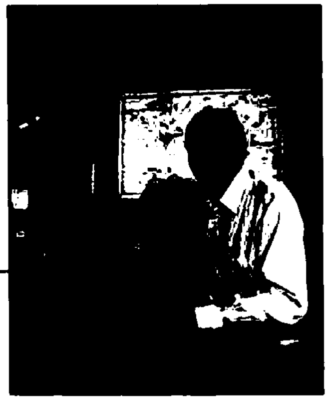

"I Don't Always Agree..."

That's the chorus at hamfests, "I enjoy your editorials, but I don't always agree with them." I want to know why the hell not. If you don't agree, is it because I'm wrong... or you are? Now, if you've done your homework and have the facts to prove I'm wrong, I want to know about it. Or am I up against your substituting conviction for information? It's a great deal easier to just believe in something than to understand it. Perhaps that's why you don't see many scientists in politics.

Speaking Of Politics...

You may recall my campaign for Vice President in the New Hampshire primary. Pulled 32,000 votes—more than DuPont, Kemp, Robertson, Gephardt, Jackson, Hart, Simon, and so on. Ha!

They spent zillions in TV promotion and advertising—I spent zilch, merely going around the state speaking to Lion's, Kiwanis, Rotary, Chambers of Commerce, etc., explaining the need to revamp American education and build ham and computer clubs as a way to get youngsters interested in electronics and communications.

Education

Education, I feel, is America's most serious problem. You've probably read the National Science Foundation report that the education we're providing our American kids puts us dead last in a 13-country list. There are many things which need to be done to improve the American educational system—my proposed electronics course being but one.

My proposal, which I've covered in some detail before, even gets around the lack of qualified science and math teachers—which normally would add a minimum of ten years to any teaching project.

Our teacher's groups have been fighting off technological aids to education with surprising success. As I've mentioned before, I'd encourage the development of home education and educational support systems—testing new ideas and using those that work the best. I'd sure want to encourage the development of a series of videos to help people get their high school certificates—to help functional illiterates learn to read and write, and even to pursue special interests.

Once we've teaching systems that work, we'll be ready to start selling these to other countries—in English and in the native language. This could make it possible some day for even the smallest country to provide a high quality education from the first grade right through college graduate work, and at a reasonable cost. Now that could really change the whole world!

Having visited many third world countries and talked at length with hams living in them, I'm familiar with their special problems: educational, political, social. I know of no simpler solution than education to what ails these countries.

A first class, low cost education would be far more valuable than economic and military aid, and incredibly less expensive. It wouldn't be all that popular with many dictators, who have been taking Uncle Sam for a merry ride by sending our aid dollars on to Switzerland and the Cayman Islands, or investing them in chunks of America a la Marcos.

If we can get the fundamentals of electronics into our grade schools we'll be on the road to regaining our lost consumer electronic industries. If we can get our unions to listen to quality guru Ed Deming and recognize that quality not only sells better, but also costs less, we might even start turning back the Toyotas.

Perhaps, if we can get more kids interested in the excitement of amateur radio, we can break the pattern of mediocrity that locks so many people into lives of so little value to themselves and the world. Perhaps, if we try, we can rescue kids from turning into

Continued on p. 97

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRM

Editorial Offices
WGE Center
Peterborough NH 03458-1194
phone: 603-525-4201

Advertising Offices
WGE Center
Peterborough NH 03458-1194
phone 800-225-5063

Circulation Offices
WGE Center
Peterborough NH 03458-1194
phone: 603-525-4201

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QRX . . .

EDITED BY BRYAN HASTINGS KA1HY/AE

Packets of Health

"Satellite" is a "Space-for-Health" project instituted by Nobel Laureate Dr. Bernard Lown of the Harvard University School of Public Health. The project invited AMSAT to participate in a meeting near Geneva 19-21 March to discuss the possible applications of the AMSAT-developed space systems and earth terminals to support communications between medicalpersonnel in remote areas. AMSAT president Vern "Rip" Riportella WA2LQQ and engineering vice-president Jan King W3GEY travelled to Annecy, France, just south of Geneva, to attend the meeting.

Rip WA2LQQ travelled to Moscow last October for an initial series of Satellite meetings. Since then, AMSAT has developed a technical proposal for a joint US-USSR project to fly a PACSAT (PACket SATellite) within 10 months. This PACSAT would not use amateur radio frequencies. An amateur radio PACSAT is also planned for construction at the same time.

Representatives from the World Health Organization (WHO) and Satellite groups from the USSR, UK, and US, attended the meetings in Annecy.

AMSAT's presentation focused on PACSAT capabilities and emphasized the possibility of very simple Earth terminals. They are to be portable and low-cost, since health workers using the Satellife PACSAT will often be working far afield in small vehicles. The PACSAT Earth terminal will be made up of two HTs, one micro TNC, a laptop computer, and will fit into an attache case fitted with an omni antenna. Radio Shack will supply the computers, Yaesu the HTs, and Tasco of Japan, the TNCs.

Canada No-Code

The Canadian Department of Communications (DOC) officially announced on 20 February that it is committed to entry-level no-code Amateur radio. The DOC is the Canadian equivalent to the FCC. This move may give impetus to the no-code license movement in the US, since the two nations often act in concert.

This move appears to be a reponse to a joint position paper that the Canadian Amateur Radio Federation (CARF) and the Canadian Radio Relay League (CRRL) submitted to the DOC. The CARF and the CRRL are Canada's two national amateur radio organizations. This proposal supported an entry-level ham ticket without a Morse code requirement.

The DOC will probably extensively revise the operator license classes. Canada currently has three amateur radio license classes—Amateur, Advanced, and Digital. The digital license is no-code, but it is un- popular, because the theory is inordinately difficult.

The CARF and the CRRL proposed a three-class restructuring, the DOC, a four-class. The proposed requirements for the entry-level no-code license for both plans are similar. Both groups also proposed for that license all modes above 30 MHz. The CARF/CRRL proposed a 100-watt limit and a lifetime license, the DOC a 250-watt limit. The DOC proposed the most interesting requirement—commercially-manufactured transmitting equipment only! They, in fact, want this requirement for three of their four proposed license levels.

Canadian amateurs will have the opportunity to comment on the government DOC proposal once the notice appears in the official government journal, the *Canada Gazette*. The restructuring will probably take place next year.

Young Ham Award

Westlink's Young Ham of the Year Award is being beefed up. Starting this year, *73 Magazine* will give a free year's subscription to the winner. In addition, Gordon West WA6NOA will furnish a complete amateur radio code and theory course to the school attended by the award winner. Falcon Communications will donate a 2-meter mobile amplifier to the person or group who wrote the nominating letter of the winner.

Yaesu USA continues to support the main prize. They supply a piece of ham gear, usually a transceiver, and cover the winner's travel and hotel expenses to and from the amateur radio convention where the award is made.

Westlink Report's Bill Pasternak WA6ITF conceived the Young Ham of the Year Award in 1986. The Award competition is open to any amateur 18 years old or younger who has performed some major public service for and/or using amateur radio. Nominating letters must be written in detail, and claims supported.

The nomination period runs until 30 June 1988. The award will be presented at the 1988 ARRL Convention in Portland, Oregon, next September.

For more info, write: Young Ham of the Year Award, *Westlink Report*, 28221 Stanley Ct., Canyon Country CA, 91352, Attn: Sanford Hicks WB6MQV

T'anks

To this month's QRX news contributors. They are: *Westlink Report*, and *W5YI Report*.

73 Magazine welcomes any and all news items and photos of interest to hams. Please send them to the magazine at WGE Center, Peterborough NH 03458-1194. Attn: QRX.

Boycott

The largest conference of Mid-western repeater coordinators may boycott the ARRL Repeater Directory if the ARRL goes ahead with plans to indiscriminately accept any submitted repeater frequency listing and coordinator names. The Mid-America Coordination Council (MACC) would conduct the boycott by refusing to furnish updated coordination to the League and by forbidding the publication of listings for their states in the book. Nebraska coordinator and former ARRL VHF repeater advisory committee chairman Joe Eisenberg WAØWRI said that a number of member states in the MACC are considering this boycott. The states that follow MACC guidelines are Missouri, Iowa, Kansas, Nebraska, South Dakota, Illinois, Oklahoma, and Wisconsin.

Trans-Ontario 2M FM Soon?

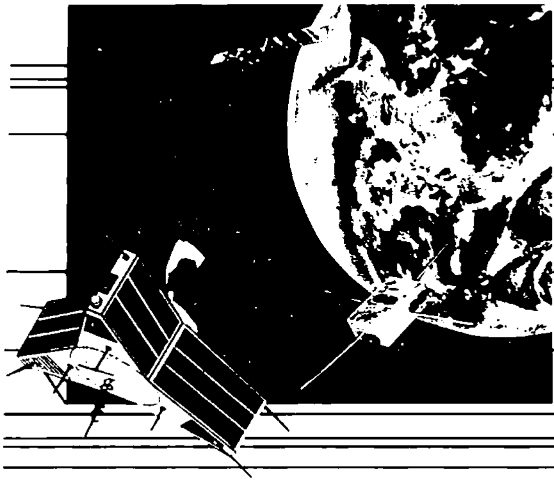
Kingston, Ontario, located at the eastern end of Lake Ontario, is the latest city to join the VE3LUR repeater chain, in official operation since 31 January 1988. Two-meter communications is now possible from London, Ontario, located 100 miles NE of Detroit, to Gananoque, 15 miles east of Kingston. The north-south link is solid from Collingwood, Ontario on the southern tip of Georgian Bay, to the US border.

HR in NY Schools

For the first time, ham radio was presented as an educational tool to teachers and administrators from across New York State at their annual middle schools convention in Rochester. Joe Fairclough WB2JKJ spoke on "Educational through Communication."

The story of the "Crew at 22" (see Aug. '87 *QRX*) came through loud and clear to an audience of non-hams concerned with the revitalization of the middle school experience for New York's students. WB2JKJ is the director of the Radio Club of Junior H.S. #22, based in Manhattan, which funds and supports classrooms in New York State and across the nation that use Amateur radio as a theme to enrich and enhance the education of young people.

Joe's ideas seem to have found favor among his colleagues. In the new officers' elections at the end of the convention, Joe won the position of New York City director for the NYC Middle Schools Association!



Why Do Satellites?

The future of ham radio is looking up.

Courtney Duncan N5BF

Amateur radio satellites are one of the great hopes for the future of the hobby. They represent new technologies, expanded use of the amateur spectrum, and opportunities to experiment and develop new capabilities. As the reader will see, hamsats have something to offer to everyone.

Amateur radio satellites are also known as OSCARs, an acronym for Orbiting Satellite Carrying Amateur Radio. The first OSCAR went up over 25 years ago. This part of the hobby has always been considered very advanced, very narrow, very technical, and very *interesting*. The current era, a period in which the Phase 3C satellite is very near its launch, is both a culmination and a conception of the technology. The role of satellites in the amateur radio service is expanding and developing in some very exciting ways.

As amateur radio moves into the future, it must continue to justify its existence in ways that an outsider can easily understand. Amateur facilities must be dependable, more precisely predictable, and high caliber, in order to approach the quality of communications service that the public has come to expect of communications carriers. Satellite-based operations easily support this standard while the ionosphere and troposphere cannot. Digital networks must be improved in quality, capacity, and coverage. Satellite-based backbones will provide a very important link in this chain as well.

The amateur satellite service is fast becoming more than just another area of the hobby in which to dabble, or even just another chapter in the Handbook which to glance through. OSCAR is becoming a ham-household word like ionosphere and troposphere are now.

Here are some examples to show that many amateur radio activities are possible on satellites.

DX

Early one Sunday morning late last November, I worked UA0ALA in Krasnoyarsk, USSR, VK7ZGK in Hobart, Australia, KE7NR in Phoenix, Arizona, JA1KX near Tokyo, Japan, VE7AIO in Clear Brook, British Columbia, and KR6B in southern California, all via OSCAR 10, and all in the space of two hours. All of the mentioned stations worked each other as well. All six contacts were more than just information exchanges—they were pleasant chats of various lengths. This is just an example of what goes on all the time on satellite DX.

The reader may say, "What's so remarkable about that? Anyone with a KW and a six-element monobander can do this." It's this very arrangement, however, that's turned many people away, myself included, from HF DX. The skip-wave DXer often clashes with his neighbors because his high power interferes with their receiving devices, and his antenna placed at an effective height is seen as an eyesore. Even if a skip-wave DXer overcomes these problems, he most often has to sit in pileups or wait his turn on lists or call-area rotations. And *then* he may wait patiently for hours, just have the band close down on him as his turn in the list comes up! HF propagation predictions still involve as much voodoo as calculating known variables.

Satellite DX contrasts heavily to its HF counterpart. My above-mentioned session didn't have pile-ups or lists—and most satellite DXing doesn't. Also openings are perfectly predictable in satellite operation—simply feed the relevant orbital elements into a satellite orbit tracking program to learn the precise duration of openings.

Power reqirements for satellite operation? Only as much as needed, and that is almost always less than 100 watts ERP. A typical satellite station uses a 10-watt output rig with a 10-dB gain antenna system.

CW

When I first made satellite contacts on OSCARs 7 and 8 several years ago, I used transverters and homebrew antennas to upgrade an HF station to satellite operations. Except during a near overhead pass of the satellite, I commonly had to use CW to hear my signal coming through clearly. Unlike many other operating modes in amateur radio today, some satellite operations still require CW for succesful operation, and most onboard beacons still transmit in CW or have CW modes that are used as part of a regular schedule. Thus, although on-board and ground-based data communications increasing use the more advanced digital modes in satellite operations, there is still an important place for CW on OSCARs.

SSB

All six of the DX contacts above were made using single sideband. With a standard satellite station and a satellite operating nominally, there is rarely a signal level requirement that precludes SSB operation. Most satellite-based contacts are made on phone. There is even an amateur satellite up now that has the ability to transmit its telemetry in spoken form through a "digitalker" chip, and it does so regularly.

Contesting

Contesters at heart will be challenged by Low Earth Orbiting (LEO) OSCAR operation. Picture this following scenario:

Fuji OSCAR 12 is about to pass over the US and the Mode J analog transponder is on. The satellite is now southwest of Hawaii, just below the horizon. Joe Sat-op's antenna is aimed in its direction, zero elevation, the 435 MHz receiver is tuned a few kHz above the beacon frequency (because the beacon will appear higher in frequency due to Doppler shift), the 145 MHz transmitter is tuned for the middle of the uplink passband, ready to go.

Suddenly, there is a faint but strengthening signal, and the CW beacon is solid, transmitting identification and telemetry at about 20 wpm. Quickly Joe tunes the receiver up into the middle of the passband. A KH6 station is calling CQ. As KH6 speaks, Joe switches between right- and left-handed circular polarization to see which results in the loudest downlink. The Hawaii op signs and Joe picks up the microphone to call but realizes that he hasn't spotted the current uplink to his current downlink frequency. Quickly Joe switches to CW for spotting and back to LSB for fine tuning. (The transponder is inverting, so LSB in the uplink is converted to USB in the downlink.) He finishes calling CQ again, "KH6. . .from. . ." Joe signs his call. He comes back, and Joe quickly exchanges the standard information with him. He comments on the view from his shack in Hawaii. It is dusk there, but night where Joe is.

After finishing, a station on the west coast calls. Signals are weaker. Joe glances at the computer elevation and azimuth printouts, and moves the antennas a little, and tries switching downlink polarization again. Both adjustments help and signals are back up strong. Tuning, Joe hear stations starting to come in from the Midwest. He moves the antennas again. Joe start a QSO with a W0. The satellite is nearing its highest elevation.

To maintain the QSO, Joe continually moves the antennas, the transmitter, and the receiver. Now stations on the east coast are showing up, and one works the KH6 just as Hawaii is losing the satellite. Joe picks up another East coast station. At this point, the Doppler rate has slowed and it is easier to stay on frequency. Joe comments about the quality of satellite signals tonight, listening to his own downlink when it takes one fade and is then gone. The downlink band is dead, and it's all over until the next orbit.

This is a typical low-orbit satellite pass, reconstructed from snatches of memories of my own satellite operations. These sometimes get so hectic that operators will tape record the session and listen later to try and figure out what happened.

This operation is not like standard contesting. The tuning, waiting, pouncing, frequency holding, and logging aspects are all there and added to that is the thrill of trying to manually keep all of the equipment on target and on frequency as the satellite flies past.

There are also technical competitions. In one, a station transmits through the satellite at lower and lower signal levels and others see how "hot" their receivers are by seeing how far down they can copy. Another contest is under development where an operator will attempt to locate a hidden transmitter by comparing its satellite relayed signals with time and frequency references and analyzing the results with a computer.

In Search of the Laid-Back QSO

Of course, contesting is not for everyone. Just as with the HF bands, there are individual operator preferences for style, mode, and frequency. Many operators came into satellite work for the wide coverage and long passes of OSCAR 10.

AMSAT has been working hard in the Phase 3 era and will continue with Phase 4 to make nominal, long duration, reliable, appliance-type operations available via satellite for those operators who prefer it or need it to support public service, emergency, experimental, and other operating styles. QSOs with meaningful and often lengthy content will be the lifeblood of amateur radio for many satellite operators as they are for many conventional operators now.

For the low-earth orbiting satellite operation, equipment is now available off the shelf that automates virtually all of the functions done manually in the LEO pass described above. The high-orbit missions like OSCAR 10 are designed to encourage and foster this very type of activity. If Phase 3C performs as advertised, it will be possible to prop modest antennas up on sawhorses on a back patio, eyeball the azimuth and elevation, and then operate for several hours with modest transmitting equipment (but a sensitive receiver, discussed below) without making any significant antenna or frequency adjustments. It is this sort of operating capability that supports long schedules, rag-chews, round tables, and nets among the traditional amateur radio activities.

Experimenters

Those who make up the amateur satellite community *need* to be experimenters. Satellite operations areat the leading edge of technology. There often is no appliance equipment available for the bands and modes of operation used with satellites. Satellite work has always been weak-signal work, too, so practitioners constantly push the state of the art to enhance the signal.

The two high-tech pursuits discussed next are just a small sampling of the many technical areas closely aligned with satellite work.

QRP is QRO

The reader should imagine himself in a raging surf trying to speak to someone on the shore. He faces in the right direction, but no matter how loud he shouts, a crashing breaker takes out half of every sentence. Seasoned operators of 20 meters should instantly see the analogy here to their DXing on that band when it is open. The only answer is to use more power. Borrow somebody's kilowatt megaphone and blast your words above the turmoil.

Now imagine a quiet meadow in the country. The pastoral wanderer sits in a clearing in the woods and the air is perfectly still. It is so quiet he can hear his analog mechanical watch ticking at his side. The person he wants to hear is on the other side of the clearing. The choice here is between the speaker speaking more loudly and the listener listening with more sensitivity. As the propogation distance increases, both are needed.

This is a typical situation at 30 MHz and above. The level of natural background noises there is several tens of dB lower below the normal HF level, particularly in the UHF frequencies and above. Indeed, the limiting factor on receiver sensitivity in amateur grade equipment is the electronic noise generated in the first RF stage of the receiver.

On a terrestrial or line-of-sight link, all else being equal, increasing transmitter power or reducing noise in the receiver front end leads to the same effect. Not so in satellite work. Power available to a satellite is limited by its power collection and storage mechanism, normally solar cells and batteries. All operators using the satellite share the available power with equipment on board the satellite. For low-earth orbiting satellites, this usually amounts to a few watts, for OSCAR 10 and Phase 3C, it is a few tens of watts. It is essential that the front end of any ground station for these satellites be "quiet" enough to hear the satellite generated or relayed signals clearly.

The satellite receivers are built to be as sensitive and quiet as possible, within practical limits. They incorporate, however, automatic gain control. The AGC in the satellite receiver operates over the transponder passband. If one station is so strong that AGC is activated, all satellite-user signals on the same transponder go down equally, and already marginal signals disappear. It's all the worse if the offending station has an inadequate receiver because he'll likely create a vicious circle by pouring out more power to hear his downlinked signal, which will be limited more and more by the AGC, and so never be satisfactory to him. This has been a chronic problem in satellite operation, because most satellite users have come up from the HF bands.

Three developments serve to reduce the problem. First, more and more OSCAR operators are understanding the nature of satellite communications, and so are investing time and energy in lower-noise preamplifiers for receivers rather than high-power amplifiers for their transmitters. Second, manufacturers are beginning to produce reasonably-priced satellite stations with quiet front ends. Third, satellites in the Phase 4 era will have "selective AGC." Using digital signal processing (DSP) or other appropriate technologies, AGC will be applied only to the louder signals in the satellite passband without suppressing other signals. Excess uplink signal will be thrown away without also hampering those users who do not have excess uplink signal.

This is a dream for QRP operators. Just how little signal does it take to achieve satellite relay? Only those with the quietest receiver front ends will know. There is elegance, simplicity, and conservation in this, all qualities of which amateur radio operators can be proud.

Especially true in satellite work, using the minimum power necessary for the intended communication is not only the law, it's also a good idea.

Digital

Since the inception of packet radio, there has been a considerable symbiosis between amateur satellite operators and digital experimenters.

At the analog end, standard modulation schemes and new, experimental ones are used, both at standard and non-standard speeds. FSK, AFSK, and PSK are all in active use. A big share of this type of experimentation is now done on the satellites and that share will increase.

The protocols used range from traditional CW to RTTY, AMTOR, and, of course, AX.25 Level 2 packet radio. The highest speed trunks, and the optimized protocols are in development for amateur satellites. Among future items are digital inter-satellite coordination. Individual users are and will be using satellites for digital communications. An AX.25 mailbox is now in orbit on Fuji OSCAR 12, and more are on the way. The Phase 3C spacecraft will have digital telemetry, bulletins, and engineering data, and an experimental digital transponder called RUDAK. The two scientific amateur satellites, UoSAT OSCARs 9 and 11, transmit most of their data to the ground digitally at 1200 bits per second.

Computers

Personal computers are becoming necessary items in most ham shacks today. Satellite-users find them especially useful. The primary use is to track the satellites, provid-

ing the numbers in real-time, or in hard-copy prepared beforehand, that tell where the antennas should be aimed from moment to moment. Other uses for the computer range from acting as a terminal with a terminal node controller (TNC) for packet operations, to full station automation and control to digital signal processing on audio signals to and from the radios.

Those who like programming are in good company in the satellite community. Most of the current leadership of AMSAT-North America have been involved in some aspect of producing satellite tracking software at some point in time and some of them even came into the program through interest in this type of programming. There are all sorts of software projects such as writing or porting software for (moving an existing program to another computer) communications, digital protocols, graphics, satellite tracking, digital signal processing, data collection, data analysis, and data archiving. There is also a need for those who can handle a personal computer in its more "traditional" role as a business machine for databasing, accounting, and word processing.

Software is available from AMSAT and from other non-profit or commercial sources to cover any of the above-listed tasks, and much more.

Hams without computers, however, can still work satellites. Those with fixed antennas (omnidirectionals, for instance), need to know only the acquisition time (when the satellite first appears on the horizon) and loss of signal time (when the satellite disappears over the horizon). These and rudimentary elevation and azimuth information are available for low earth orbit satellites from a simple graphic device called an "OSCARlocator." This device is used with information available on AMSAT HF nets and mailed publications. There is also appropriate information available via the satellites themselves, in automated CW telemetry, and in the future on nets. Phase 3C will require less actual tracking for more on-the-air time, and Phase 4 will be in geosynchronous orbit. In the last case, one needs only to obtain coordinates once, aim, peak, and lock down!

Small Lots, Country Estates

A trend these days, particularly for technical types (such as many involved in ham radio, is living in the city or the suburbs. This usually means little or no lot space, and many neighbors nearby. These constraints make it very difficult to install an adequate antenna system for HF hamming.

Not so, however, for satellite work, as my own example shows. I live on a small lot in a large city. All of my amateur transmitters (aside from hand-helds) are in the 25–30 watt output class. My very adequate antenna system is only 20 feet high and requires an eight-foot spherical turning radius. It barely clears the house. Given ten times the money and ten times the space, I could only marginally improve my receiving situation. A single, circularly polarized crossed yagi for each band, a modest transmitter, and a quiet receiver are all that is required for consistent, reliable operation.

I had made a satellite contact even before I got my satellite antennas! In my impatience, I used a magnetic mount quarter wave for one band, and the antenna from a hand-held transceiver for the other band, and completed a QSO via Fuji OSCAR 12. Other amateurs have conducted successful satellite operations from their cars using a pair of radios and mobile antennas. If Phase 3C performs as advertised, these kinds of operations will become routine.

Folks in the country can have a fully adequate satellite station that possibly has less environmental impact than the antenna system they require for terrestrial TV reception.

More room means more ambitious experiments. Using moonbounce-class antennas and quiet receiver front ends, it's possible to hear the noise floor of most if not all amateur satellite receivers being retransmitted by its associated transmitter. Information on the signal level and nature of this noise floor is useful to satellite designers and operators. Also, tests of signal level and quality at and even slightly below the horizon are of interest to the user community. Those with plenty of received signal with which to work are best equipped to pull out marginal stations. This could be critical in emergency communications.

Continued on page 76

73 Review *by Dan Kernan NX2C*

The New Ten Tec Paragon Transceiver

Ten-Tec Co.
Highway 411 East
Sevierville TN 37862
Price $2,245

For those of us that grew up in amateur radio, companies like Johnson, Hallicrafters, and National seemed as American as McDonalds or Burger King today. When the imported wave of ham gear hit America's shores in the 70s, many of these famous names disappeared from the ham shack and vocabulary. One American equipment manufacturer still around is Ten Tec from Sevierville, Tennesse. The Smokey Mountains are hardly Silicon Valley. When Al Kahn K4FW and Jack Burchfield K4JU founded the company in 1968, it quietly gathered a faithful following, and the product certainly deserved a look over. The Ten Tec Company has developed an excellent reputation for fast and thorough service at an honest cost. This was no small achievement in the highly competitive ham market.

Ten Tec's latest venture into the amateur market is the all-band HF rig the Paragon. As a satisfied Ten Tec Corsair owner, I was most interested when the dealer ads appeared in *73* for the Paragon. Ten Tec has made a radical departure from their normal no-frills approach in ham gear with new features in the Paragon, such as microprocessor frequency control, two VFOs, general coverage receiver, and a bank of memory channels.

Let me clarify the no-frills statement: It's not intended to indicate a lack of performance, but simply the lack of bells and whistles that hams have come to expect on the imported models.

In the Beginning...

Let's begin with a major problem with the Paragon–obtaining one. While the prototypes were around in 1986, dealers would not accept orders for the Paragon until early 1987. I placed my order around the first of March 1987, and the rig arrived the first week of September. A six-month wait. That's a little like telling a five-year-old that Christmas has been postponed until July. When checking with Ten Tec in the summer of 1987, the Company indicated a production of 100 units per month with about 250 orders back logged.

The Blessed Event

Well, the UPS man finally did show up with Model SN:057, which I hurriedly unpacked and plugged into it's outboard Model 960 power supply/speaker. I was immediately impressed with the physical size of the unit, a somewhat large 5¾" x 10¾" x 17". The control knobs were also a good size. Having large paws, the small oriental knobs can be a problem for me.

The Paragon is a synthesized transceiver. It has a general coverage, all-mode receiver (SSB, AM, CW, FSK, and optionally FM) that tunes from 100 kHz to 29.999 MHz. The Paragon comes complete with a 2.4 kHz SSB filter and 6 kHz AM filter. The AM filter makes for very comfortable listening, especially to the foreign broadcasts and the local 50's rock station. There are provisions for optional plug-in filters for 1.8 kHz SSB, .500 and .250 kHz CW and FM transceiver plug-in option, available since the end of 1987. The user can select filters regardless of operating mode. A voice synthesizer for frequency readout and an RS-232 interface for computer control will be available soon.

Receiver

How is the Paragon's receiver? In a word, quiet. Ten Tec has managed a very quiet PLL oscillator, and indeed Ten Tec indicates that much of the three-year engineering effort was invested in improving receiver performance and inherent PLL phase noise. Tuning across the bands between signals will quickly attest to Ten Tec's success in achieving the company's goal. There were only a few minor "blips" on the 10 meter band; otherwise the receiver was very quiet.

The blue flourescent display is switch selectable for 100 Hz or 10 Hz readout, and a slow–fast control for tuning. Frequency selection can be made using the main tuning knob, keyboard entry pad, or the up/down buttons that step in one megahertz increments or to the next ham band.

Ten Tec has installed a tag in the frequency display area. This tag feature shows the date or the current 12 or 24 hour time, which is displayed by repeated touches of the display key. The tag, or memo feature, may be used to write in up to a 7-digit alphanumeric message, such as net name, callsign, or ID. The function keys double as an alphanumeric keypad with which to write the electronic memos. A combination of display messages in the 62 memories and the scan feature makes the radio light up like the Fourth of July in Philadelphia! The memory channels retain mode, filter, tag, and frequency automatically.

Additional receiving functions are passband tuning, which shifts the IF +/- 1.2 kHz; a tunable audio bandpass filter, a 4-pole device with a variable center frequency of 220 to 1.7 kHz; an additional 250 to 2.2 kHz notch filter with more than 50 dB of notch depth; a variable tone control; the -20 dB attenuator; and a receiver capable of handling just about any condition the bands can dish out in terms of QRM. Completely removing the carrier of a "tuner upper" from the frequency presents no problem. The CW selectivity with any optional filters is quite good, as I discovered in the recent November sweepstakes contest on CW.

The CW sidetone SSB monitor volumes are adjustable independently of the AF gain.

Transmitter

On the transmit side of things, there is a choice of upper or lower sideband, regardless of band chosen, plus CW and FSK (FM optional). The RF output is ALC stabilized and adjustable 10 to 100 watts with the front panel control. The low impedance microphone input provides voltage to power an electret mic element. A speech processor increases the ratio of consonant to vowel sounds to increase articulation up to 10 dB. Broadcast quality reports, with and without the speech processor, were all very favorable on many contacts. The processor did give an added punch without reducing audio quality.

Internally, all circuit boards are glass epoxy and easily removed without desoldering. The front panel is hinged to provide access to all sections of the chassis. Only four screws are needed to remove either the top or bottom covers. The roomy interior can store a lunch and almost a six-pack for Field Day. The shades of gray are a little reminiscent of the older Collins "S" line.

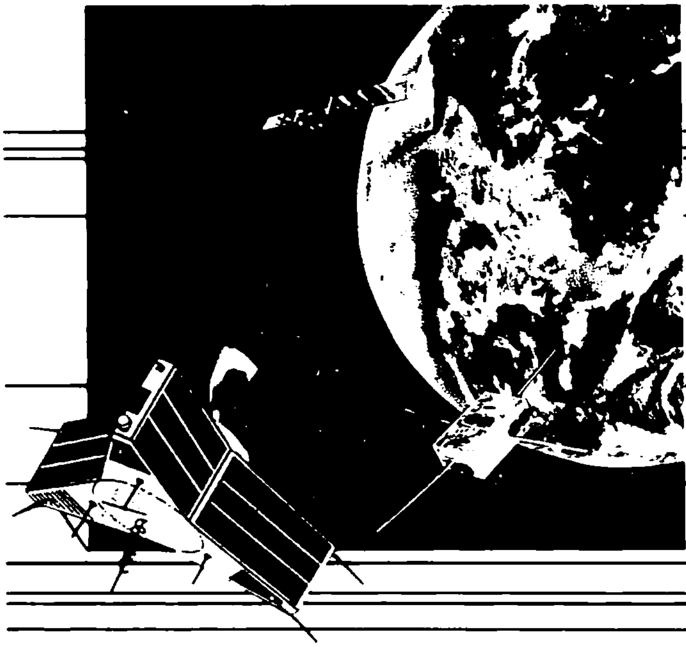
Summary

Ten Tec has apparently aroused considerable interest with this radio, having had several visits from a number of local hams who would like to own one. The Paragon seemed to please even the demanding big gun DX types with its sensitivity and selectivity.

The improvements needed would include a panel-mount level controls for the internal monitor, and perhaps VOX gain and delay controls on the front panel instead of the rear, otherwise the Paragon was enjoyable to operate.

The Paragon is a first class amateur transceiver with an impressive list of features. It has the look, feel, performance and price of a professional piece of radio equipment. If a new HF transceiver is in your future, the Paragon warrants some serious consideration. ■

Readers interested in reviewing equipment for *73* should send us an SASE requesting a Reviewers Questionnaire.



UoSATs: The British Connection Part I

University of Surrey's Contributions to Hamsats

by Robert J. Diersing, N5AHD

UoSAT-OSCAR-9 was launched in October 1981 followed by UoSAT-OSCAR-11 in March 1984. The spacecraft are frequently called UoSAT-1 and UoSAT-2, respectively. Both were designed and constructed by the Department of Electrical Engineering at the University of Surrey, England.

A Breed Apart

These spacecraft are different from other amateur radio satellites in that they carry no transponders for general communications use. Instead, they carry various scientific and spacecraft systems experiments. Some experiments are dedicated to gathering data of interest in scientific research, while other experiments serve to gather data related to the implementation of future spacecraft control systems. Of particular interest are those systems that are low in cost and yet reliable in the space environment.

One of the primary objectives for the UoSAT program has been to stimulate a greater degree of interest in space sciences among schools, colleges, and universities by enabling active participation. This goal has been realized to a greater degree in countries other than the United States. Perhaps one reason USUoSAT experimentation has been slow to develop is the apparentthe lack of publicity about the satellites.

I have followed the operation of UoSAT-1 and UoSAT-2 since they were launched. Monitoring the UoSATs is done from both my home and the Corpus Christi State University Advanced Microcomputer Laboratory. Fully automated tracking and data collection stations have been developed and are in operation at the both stations. The details of these systems have been published in a number of amateur satellite related publications.

UoSAT Data

For UoSAT-1 there are four different data types that transmitted as plain text–the onboard computer status, bulletins, standard sixty channel telemetry frames, and whole-orbit telemetry.Two examples of these four data types can be seen in Figures 1A and B. Both the sixty-channel telemetry frames and the whole-orbit telemetry will be discussed in detail later.

UoSAT-2 transmits these same four types plus one other–the Digital Communications Experiment (DCE) message headers. This experiment is very important, because it demonstrates the feasability of store-and-forward packet message systems using low-cost satellites. Samples of data captured from the UoSAT-2 downlink can be found in Figures 2A and B. During a pass with a reasonable visibility time, all of the different data types will be observed.

UoSAT-1 sometimes transmits previously stored images taken by a coupled-charge device (CCD) imager. When CCD images are transmitted, a synchronous transmission format is used on the downlink rather than the usual asynchronous format. The latter is much easier to handle on commonly available personal computer equipment.

```
UOSAT-1              8802280125320 COMPUTER GENERATED TELEMETRY
000303010100027005030012040015056542063 38E0727200838470948 72
1013031106061200031337241432371 5193F1643551736561839301 93803
201506212302226 59A23006724012525401226424627330528381029207E
302302310002326722332772340061353621363633373227383901395528
4014014116024273644314 9B441313450801460064473 84C48373B49430A
501602510 90D52279B530879545343553751564 49P57400658397059416F

UOSAT-1              8802280125324 COMPUTER GENERATED TELEMETRY
000303010100027005030012040015056542063 38E0727200838470948 72
1013031105051200031337241431161518 1C1642101735001839301 93784
2005062124052266002300672401252540122643 9A27329D2838102920 90
3024053101033267223327633400613536123636443732273839013955 39
40140141160242736443148A4413134500014600574738 4C48373B49430A
5016025109 0D52279B5308795453525537625644 8B57400658397059416F
```

Figure 1A. UoSAT-1 Standard Telemetry Frames.

```
000000301 30286C
000800137 3376B2
00100023733376A9
00180023733376A1
0020001373376 9A
00280013733769 2
0030001373375 8B
0038001373376 82
0040001373376 7A
0048001373376 72
0050001373376 6A
0058001373376 62
0060001373376 53
0070002373376 49
0078002373376 41
0080003373376 38
0088002373377 30
0090002373377 28
0098002373377 20
00A0002373377 18
00A8002373377 10
```

Figure 1B. UoSAT-1 Whole-Orbit Telemetry.

Channel	Measurement	Calibration Equation
00	Secondary S/C Computer	1.2N mA (0.125A < I < 1A)
01	Solar Array Current +X	200 + 1.12N mA
02	Battery Half Voltage	W/100 * 1.01
03	Radiation Detector A O/P	40N * 1.04 Counts/Sec
04	Radiation Oetector B O/P	40N * 1.04 Counts/Sec
05	Magnetometer Expt. HY-Coarse	INT(NYC/63.5+0.689)*8054-FY
06	Magnetometer Expt. HX-Coarse	INT(NXC/63.5+0.689)*8103-FX
07	Magnetometer Expt. HZ-Coarse	-INT(NZC/63.5+0.689)*8009+FZ
06	Battery Pack A Temperature	(474-N)/5 * 1.01 Degrees C
09	S/C Facet Temperature +X	(474-N)/5 * 1.01 Degreea C
10	CCD Experiment Current	1.2 * (N-30) mA (0.15A < I < 1A)
11	Solar Array Current -Y	200 + 1.12N mA
12	2.4 GHz Beacon Expt. Power	(N-145) * 0.45 mW
13	Radiation Expt. EHT Volts	N Volts
14	Radiation Detectors Current	(N+20)/6 * 0.983 mA
15	Magnetometer Expt. HY-Fine	PY=18.55 * (NPY-495.7)
16	Magnetometer Expt. HX-Fine	PX=18.53 * (NFX-496.45)
17	Magentometer Expt. HZ-Fine	FZ=18.34 * (NPZ-493.55)
18	Battery Pack B Tempertature	(474-N)/5 * 1.01 Degreea C
19	S/C Facet Temperature -X	(474-N)/5 * 1.01 Degrees C
20	S/C Computer Power	1.2 * (N-25) mA
21	Solar Array Current -X	200 + 1.12N mA
22	Battery/BCR 14V Bus	N/50 * 1.056 Volts
23	Sun Sensor +Z Axis	N/200 * 1.01
24	10.47 GHz Beacon Expt. Current	(N-40)/4 * 0.97 mA
25	Magnetometer Expt. Temperature	(467-N)/6.85 Degrees C
26	Magentometer Expt. Current	(N/8) * 0.9945 mA
27	Telecommand Receiver Current	(N-16)/8 * 0.952 mA
28	Radiation Expt. Temp. +X1	(474-N)/5 * 1.01 Degrees C
29	S/C Facet Temperature -Y	(474-N)/5 * 1.01 Degrees C
30	Battery Charge Current	2.9N mA
31	Solar Array Current +Y	200 + 1.12N mA
32	Power Cond. Module +10V	N/60 * 0.93 Volts
33	Telemetry System Current	(N-16)/30 * 1.084 mA
34	2.4 GHz Beacon Expt. Current	0.4*(N-11) * 1.072 mA
35	145 MHz Beacon Power O/P	(N-82) * 1.67 mW
36	145 MHz Beacon Current	(N-7)/4 * 1.014 mA
37	145 MHz Beacon Temperature	(474-N)/5 * 1.01 Degreea C
38	Primary S/C Comp. Temp. -X1	(474-N)/5 * 1.01 Degrees C
39	S/C Facet Temperature +Y	(474-N)/5 * 1.01 Degrees C
40	+14V Line Corrent	2.86N mA
41	+5V Line Current	1.28(N-50) mA (0.075A < I < 1A)
42	Power Cond. Module +5V	2N/300 * 1.12 mA
43	Sun Sensor -Z Axia	N/200 * 1.01
44	HF Beacons Expt. Current	(N-36)/3 * 1.038 mA
45	435 MHz Beacon Power O/P	(N-102) * 1.792 mW
46	435 MHz Beacon Current	(N-34)/3 * 1.053 mA
47	435 MHz Beacon Temperature	(474-N)/5 * 1.01 Oegrees C
48	Secondary S/C Comp. Temp. -Y1	(474-N)/5 * 1.01 Degrees C
49	S/C Facet Temperature +Z	(474-N)/5 * 1.01 Degreea C
50	+10V Line Current	3N mA
51	-10V Line Current	1.3*(N-60) mA
52	Power Conditioning Module -10V	0.0158N - 0.0224n (n=Channel 32)
53	Navigation Magnetometer Y-Axis	(N-663.44)*183.486 nT
54	Navigation Magnetometer Z-Axis	-(N-336.55)*189.54 nT
55	Navigation Magnetoneter X-Axis	-(N-496.5)*194.55 nT
56	Speech Synthesiser Current	(N-16)/10 * 1.009 mA
57	CCD Imager Temperature	(474-N)/5 * 1.01 Degrees C
58	Telemetry System Temp. +Y1	(474-N)/5 * 1.01 Degrees C
59	S/C Facet Temperature -Z	(474-N)/5 * 1.01 Degrees C

Table 1. UoSAT-OSCAR-9 telemetry channel calibration equations.

Number	Description	0	1
01	145 MHz Beacon Power	Off	On
02	435 MHz Beacon Power	Off	On
03	2401 MHz Beacon Power	Off	On
04	Telemetry Channel Mode Select	Run	Dwell
05	Telemetry Channel Dwell Addr Load	Off	On
06	Telemetry Channel Dwell Addr Source	Ground	Computer
07	Primary Spacecraft Computer Power	Off	On
08	Primary S/C Computer Error Count	Bit-1	Bit-1
09	Primary S/C Computer Error Count	Bit-2	Bit-2
10	Primary S/C Computer Bootstrap	PROM	UART
11	Primary S/C Computer Error Count	Bit-3	Bit-3
12	Primary S/C Computer Bootstrap	A	B
13	Gravity Gradient Boom Deploy Pyros	Safe	Arm
14	Gravity Gradient Boom Oeploy Pyros	Bold	Fire
15	Gravity Gardiant Boom Oeploy	Safe	Arm
16	Gravity Gradient Boom Deploy	Hold	Deploy
17	Gravity Gradient Boom Deploy	Extend	Retract
18	Attitude Control Magnetorquers	Safe	Arm
19	Attitude Control Magnetorquer -X	On	Off
20	Attitude Control Magnetorquer -Y	On	Off
21	Attitode Control Magnetorquer -Z	On	Off
22	Attitude Control Magnetorquer	Reverse	Forward
23	435 MHz Beacon PSK Mode	NRZI	NRZIC
24	2401 MHz Beacon PSK Mode	NRZI	NRZIC
25	Attitude Control Magnetorquers	High Power	Low Power
26	Digitalker Expt. Power	Off	On
27	CCD Camera Expt. Power	Off	On
28	CCD Camera Expt. Integration Period	Bit-0	Bit-0
29	CCD Camera Expt. Integration Period	Bit-1	Bit-1
30	CCD Camera Expt. Video Amp. Gain	Bit-0	Bit-0
31	CCD Camera Expt. Video Amp. Gaia	Bit-1	Bit-1
32	DSR Power	Off	On
33	DSR Mode	Read	Write
34	DSR Mods	Run	Reset
35	Radiation Detector A EHT Power	Off	On
36	Radiation Detector B EHT Power	Off	On
37	Radiation Detector C EHT Power	Off	On
38	Electron Spectrometer EHT Power	Off	On
39	Data Commpuncations Expt. Power	Off	On
40	Data Communications Expt.	Reset	Run
41	Data Communications Expt. PROM	A	B
42	Data Communications Expt. Clock	0.9 MHz	1.8 MHz
43	Navigation Magnetometer Power	Off	On
44	Space Dust Expt. Power	Off	On
45	Status Calibrate		
46	BCR Status	0	1
47	435 MHz Beacon Modulation Select	AFSK	PSK
48	2401 MHz Beacon Modulation Select	AFSK	PSK
49	Engineering Data	Bit-1	Bit-1
50	Engineering Data	Bit-2	Bit-2
51	Engineering Oata	Bit-3	Bit-3
52	Engineering Data	Bit-4	Bit-4
53	Engineering Data	Bit-5	Bit-5
54	Command Watchdog Enable	Disable	Enable
55	Command Watchdog Reset	0	1
56	145 MHz Downlink Data Select	A	
57	145 MHz Oownlink Data Select	B	
58	145 MHz Downlink Data Select	C	
59	145 MHz Downlink Data Select	D	
60	145 MHz Downlink Data Select	E	
61	145 MHz Downlink Data Select	F	
62	145 Mhz Downlink Data Rate	A	
63	145 MHz Downlink Data Rate	B	
64	435 MHz Downlink Data Rate	A	
65	435 MHz Downlink Data Rate	B	
66	435 MHz Downlink Data Rate	C	
67	Particle/Wavecounter Control	Count	Reset
68	Downlink Lockout	Enable	Disable
69	Engineering Data	Bit-6	Bit-6
70	Engineering Oata	Bit-7	Bit-7
71	Engineering Oata	Bit-8	Bit-8
72	Engineering Oata	Bit-9	Bit-9
73	P/W Channel Plate Control	Bit-0	Bit-0
74	P/W Channel Plate Control	Bit-1	Bit-1
75	P/W Channel Plate Control	Bit-2	Bit-2
76	Space Dust (MSB)	Bit-7	Bit-7
77	Space Oust	Bit-6	Bit-6
78	Space Dust	Bit-5	Bit-5
79	Space Dust	Bit-4	Bit-4
80	Space Dust	Bit-3	Bit-3
81	Space Dust	Bit-2	Bit-2
82	Space Dust	Bit-1	Bit-1
83	Space Dust (LSB)	Bit-0	Bit-0
84	DSR Write Cycle Complete		
85	1802 CWO Output		
86	1802 TLM Port (MSB)	Bit-10	Bit-10
87	1802 TLM Port	Bit-9	Bit-9
88	1802 TLM Port	Bit-8	Bit-8
89	1802 TLM Port	Bit-7	Bit-7
90	1802 TLM Port	Bit-6	Bit-6
91	1802 TLM Port	Bit-5	Bit-5
92	1802 TLM Port	Bit-4	Bit-4
93	1802 TLM Port	Bit-3	Bit-3
94	1802 TLM Port	Bit-2	Bit-2
95	1802 TLM Port	Bit-1	Bit-1
96	1802 TLM Port (LSB)	Bit-0	Bit-0

Table 2. UoSAT-OSCAR-11 spacecraft systems status points.

UoSAT-2 also transmits CCD images from time to time, and asynchronous transmission is used, but it is at 4800 bps on the 70 cm downlink rather than the usual 2m downlink. The times scheduled for CCD transmissions appear in the weekly bulletins from the spacecraft.

Equipment Required

Most of the time UoSAT-1 and UoSAT-2 transmit on 145.825 MHz FM +/− Doppler. During a pass where the elevation of the satellite in the sky is high enough with respect to the listener, the UoSATs can be heard using a two meter hand-held unit. However, for consistent results some type of outside antenna should be used. Of course the optimum situation would be some type of gain antenna which can track the satellite.

Data Capture and Analysis

For any practical analysis and use of the data transmitted by UoSAT, it must be somehow captured and processed by computer. This may sound complicated, but there are actually several alternatives. First, the audio from the two meter FM receiver may be fed to a Bell-202 modem and the modem connected to a CRT or hardcopy terminal. Second, the received audio could be tape recorded and the demodulation and processing deferred until later. Third, and probably the most desirable, the modem could be hooked to some type of personal computer where the data would be captured in memory and


```
UOSAT-2                  880217303213
0052250128920236250346890405230503 9F06026207051308045909034E
1052241132101200031105 8F14104A15486K16192D175517186 01K195428
20522721221222660023000124001725000726094927569F285841294935
30522431015432204033560334110735235234291F374275384681394961
40653441128642641543008F441652450001460002474 90F48495449440F
50441651109C52640553646254712555000056000357490F564845594877
60832F615FD0625FC26332406444026514046 6C01D678009680008 69000F

UOSAT-2                  880217303213 8
0052250129390236160343400405230503 9F06026207051300045909034E
10522411321012000313058F14191C15487F16193C175524106 01B19543A
20522721219922660023000124001725000726094927569F285843294935
30522631015432286D33564734088735235236291F374275384681394961
40653441120642641543008F0414524500814400024740 0F46495449460F
50461651109C52640553646254712555000056000357490F564845594677
40632F615FD0625FC263324064440265140646C01D676009680086 9000F
```


Figure 2A. UoSAT-2 Standard Telemetry Frames.

```
DCB Message System V1.2
ZOAC=61 FREE MEM=03F8 NEXT MSG=1CB CMD#=37B0 ERR=00 BANK OF BAM=0081 02BB

          To KIKSY De GB2UP Re: batch of messages
          To KIKSY De: GB2UP Re:batch 09-Jan (2)

SATELL   EPOC          INCL   RAAN   ECCN   ARGP    MA     MM        DECY   REVN
UO9      88017.03627   97.63  45.50 0.0002 151.13 208.86 15.31181  6.2E-5 14944
AO10     88009.09680   27.44 341.78 0.4026 270.99  25.00  2.05883 -6.0E-7  1440
UO11     88015.22249   98.08  81.45 0.0013 147.81 212.19 14.62216  2.1E-6 20668
M2-15    88018.48193   82.47 207.34 0.0012 267.41  92.57 13.83577  6.0E-8  5230
M2-16    88018.14032   82.54 248.35 0.0012 199.33 160.74 13.83334  4.8E-7  2116
MJ-1     88018.10135   82.55 240.64 0.0019 144.49 215.76 13.16925  4.3E-7 10759
N-9      88004.41281   99.08 337.04 0.0016   3.43 356.69 14.11542  9.0E-7 15770
N10      88011.22842   98.69  44.23 0.0013 324.02  36.01 14.22538  2.0E-6  6860
RIR      88019.79994   51.63 122.60 0.0016 352.04   7.91 15.74602  2.3E-4 11010
SALYUT-7 88018.79643   51.61 295.58 0.0000  43.9 316.14  15.31923  6.7E-5 12902
AJISAI   87106.47345   50.01 320.17 0.0011 277.23  82.72 12.44370 -2.5E-7  5561

     TO:KIKSY DE:GB2UP RE:MESSAGE BATCB 291067
     TO:WA9FMQ DE:GB2UP  RE:MESSAGE BATCH
     TO:NK6K DE:GB2UP RE:MESSAGE BATCB
```

Figure 2B. UoSAT-2 DCE Message Headers.

Channel	Measurement	Calibration Equation
00	Solar Array Current -Y	1.9 * (516-N) mA
01	Nav. Magnetometer X-Axis	0.1485N-68 uT
02	Nav. Magnetometer Y-Axis	0.1523N-69.3 uT
03	Nav. Magnetometer Z-Axis	0.1507N-69 uT
04	Sun Sensor No. 1	
05	Sun Sensor No. 2	
06	Sun Sensor No. 3	
07	Sun Sensor No. 4	
08	Sun Sensor No. 5	
09	Sun Sensor No. 6	
10	Solar Array Current +Y	1.9 * (516-N) mA
11	Nav. Magnetometer (wing) Temp.	(330-N)/3.45 Degrees C
12	Horizon Sensor	
13	Spare	
14	DCE Ramunit Current	(N-70.4)/6.7 mA
15	DCE CPU Current	(N-187.1)/2.0 mA
16	DCE GMEM Current	(N-121.3)/2.1 mA
17	Facet Temperature +X	(480-N)/5 Degrees C
18	Facet Temperature +Y	(480-N)/5 Degrees C
19	Facet Temperature +Z	(480-N)/5 Degrees C
20	Solar Array Current -X	1.9 * (516-N) mA
21	+10V Line Current	0.97N mA
22	PCM Voltage +10V	0.015N Volts
23	P/W Logic Current +5V	0.14N mA (N <= 500)
24	P/W Geiger Current +14V	0.21N mA
25	P/W Elec. sp. Current +10V	0.096N mA
26	P/W Elec. sp. Current -10V	0.093N mA
27	Facet Temperature -X	(480-N)/5 Degrees C
28	Facet Temperature -Y	(480-N)/5 Degrees C
29	Facet Temperature -Z	(480-N)/5 Degrees C
30	Solar Array Current +X	1.9 * (516-N) mA
31	-10V Line Current	0.48N mA
32	PCM Voltage -10V	0.036N Volts
33	1602 Computer Current +10V	0.21N mA
34	Digitalker Current +5V	0.13N mA (N <= 500)
35	145 MHz Beacon Power	(2.5N - 275) mW (N > 200)
36	145 MHz Beacon Current	0.22N mA
37	145 MHz Beacon Temperature	(480-N)/5 Degrees C
38	Command Decoder Temperature +Y	(480-N)/5 Degrees C
39	Telemetry System Temp. +X	(480-N)/5 Degrees C
40	Solar Array Voltage +30V	(0.1N-51.6) Volts
41	+5V Line Current	0.97N mA
42	PCM Voltage +5V	0.0084N Volts
43	DSR Current +5V	0.21N mA (N <= 500)
44	Command Receiver Current	0.92N mA
45	435 MHz Beacon Power	(2.5N-200) mW (N > 175)
46	435 MHz Beacon Current	0.44N mA
47	435 MHz Beacon Temperature	(480-N)/5 Degrees C
48	P/W Tempreature -X	(480-N)/5 Degrees C
49	HCR Temperature -Y	(480-N)/5 Degrees C
50	Battery Charge/Discharge Current	8.8(N-513) mA
51	+14V Line Current	5N mA
52	Battery Voltage +14V	0.21N Volts
53	Battery Cell Volts Mux	
54	Telemetry System Current +10V	0.02N mA
55	2.4 GHz Beacon Power	((N+50)**2)/480 mW
56	2.4 GHz Beacon Current	0.45N mA
57	Battery Temperature	(480-N)/5 Degrees C
58	2.4 GHz Beacon Temperature	(480-N)/5 Degrees C
59	CCD Imager Temperature	(480-N)/5 Degrees C
60	Status Points 01-12	
61	Status Points 13-24	
62	Status Points 25-36	
63	Status Points 37-48	
64	Status Points 49-60	
65	Status Points 61-72	
66	Status Points 73-84	
67	Status Points 85-96	
68	Spare	
69	Spare	

Table 3. UoSAT-OSCAR-11 telemetry channel calibration equations.

later saved on disk. Data capture programs for the IBM PC and compatibles are available from the AMSAT-NA Software Exchange and AMSAT-UK.

A little more discussion on modems is required. A Bell type 202 modem is required for demodulation of UoSAT transmissions. A Bell-212A modem will not work. Modems such as the Hayes Smartmodem 1200 are Bell-212 type modems and cannot be used for demodulating UoSAT transmissions. The differences lie in the tone frequencies and the type of modulation used.

Bell-202 modems can sometimes be found at hamfest flea markets. They can also be built from circuits that have been published in the various ham magazines. Also, typical modems used with VHF packet radio are Bell-202 compatible. This alternative is particularly attractive when there is an existing modem disconnect jack.

Another point to watch for is that the tone sense between UoSAT-1 and UoSAT-2 is reversed; that is the tones used to represent a zero bit and a one bit (mark and space) are opposite. UoSAT-1 telemetry can be demodulated with a standard Bell-202 modem, while data from UoSAT-2 must be inverted before it can be processed.

I have several UDS-202C modems are in service. I have also used the G3RUH UoSAT modem with equal success. A printed circuit board for the the G3RUH modem is available from AMSAT-UK.

Standard Telemetry Format

The telemetry frames shown in Figures 1A and 2A are standard sixty-channel frames for UoSAT-1 and UoSAT-2, respectively. The other frame types evolved later, and the scheme of switching among different types started with the commissioning of the Diary programs in late 1985 and early 1986.

The standard telemetry frames contain data about the status of the spacecraft systems and also contains telemetered values from the spacecraft housekeeping systems and onboard experiments. The examples shown in Figures 1A and 2A are actual telemetry frames captured while preparing this article. For both UoSAT-1 and UoSAT-2, the lines beginning with 00 through 50 contain the actual telemetry measurements. Each of these lines consists of ten sets of a two-digit channel number followed a three-digit value followed and a check digit. The check digit validation scheme is the same for both UoSAT-1 and UoSAT-2.

The header line is similar in both frames and contains the date, day of week, and UTC time of transmission. In the UoSAT-2 frame, the last line contains the status of all of the onboard systems: active and inactive systems, downlink data rate, downlink modulation type and so forth. Currently, there is no similar indication of systems status in the UoSAT-1 frame.

No matter which data format is processed, the values from the channels of interest must be converted to engineering units. This is done by substituting the value from the telemetry into a calibration equation. Some channels use the same equations while others are different. A few examples of conversions of telemetered values to engineering units for UoSAT-1 follow.

Consider one of the least complicated equations.

Channel Number Telemetered Value

50160

I = 3 × N mA = + 10V Line Current
I = 3 × 160 = 480 mA

Some equations are more complicated. Channel No. 27 = I of Telecommand Receiver 27330

I = 0.125 × (N − 16) × 0.952 mA
I = 0.125 × (330 − 16) × 0.952
= 37.369 mA

Other equations may require values from two channels.

Channel No. 05 = Magnetometer Experiment HXC
Channel No. 15 = Magnetometer Experiment HXF

05654
15193

Bx = (129 × NXC − 64324) − 18.05 × (NXF − 511) nT
Bx = (129 × 654 − 64324) − 18.05 × (193 − 511) nT
Bx = 25781 nT

The examples shown above represent the range of complexity that will be encountered. A complete list of calibration equations for both satellites can be found in Tables 1 and 3. Note the calibration equations do change from time to time. If you are doing serious experimental work, it would be wise to check with an authoritative source.

The spacecraft systems status line is a bit more difficult to decode. The 96 systems status points are encoded in channels 60-67. Status points 1 through 12 are encoded in channel number 60. Each ASCII character is interpreted as a hex nibble. For example, 60400 means that status point 2 is set while 1 and 3 through 12 are reset. A listing of the systems status points for UoSAT-2 can be found in Table 2.

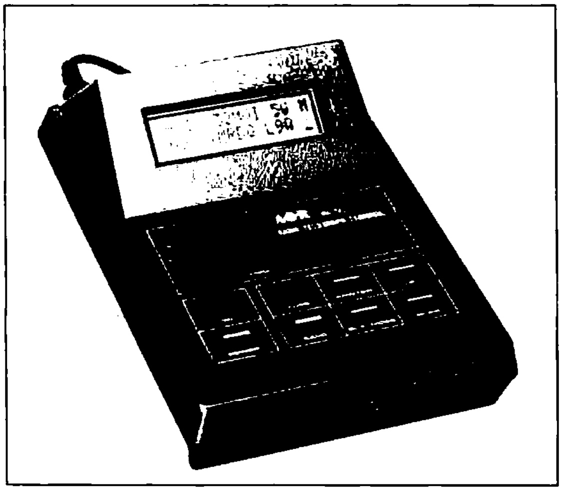
Software for capturing and decoding UoSAT telemetry is available from the AMSAT-NA Software Exchange and from AMSAT-UK. The package available from AMSAT-NA consists of three programs for IBM PCs and compatibles. One of the programs supplied will capture data from UoSAT in memory and then allow the memory buffer to be saved on disk. This has probably been the program most needed to accomplish any serious data analysis. Another program is available to edit the standard telemetry formats and save a new file consisting of only complete telemetry frames. Finally, there is a program to read the edited file and produce a decoded telemetry report.

Next month: Part II Whole Orbit Data

Number 7 on your Feedback card

NEW PRODUCTS

Compiled by Linda Reneau

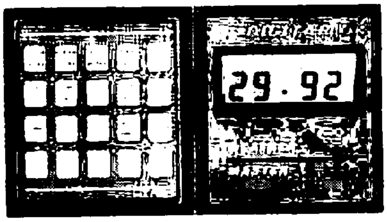


PRODUCT OF THE MONTH

ACE COMMUNICATIONS

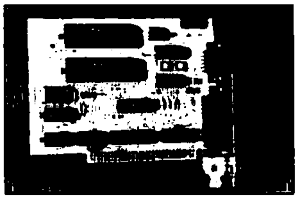
ACE Communications, Inc., introduces the AR-501 Radio Telegraph Terminal, a triple-mode radio telegraph (CW) terminal for amateur radio operators and shortwave listeners.

The AR-501 is a CW decoder, trainer, and electronic keyer. Features include automatic speed follow-up and threshold control, LED tuning indicator, 32-character LCD display, random code generator, and electronic with both standard and iambic modes. Code can be routed to an internal speaker, and to a printer through the parallel printer port of the unit. The AR-501 measures 4.5" x 6.25" x 2.25". A 12-VDC source powers it. The user price is $229, including AC power adaptor and parts for hookup. For further details, contact *ACE Communications, Inc., 22511 Aspan Street, El Toro CA 92630; 714-581-4900.* Or circle Reader Service number 201.



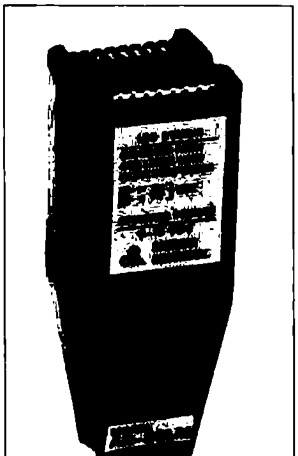
MAGNAPHASE

The ALT-4 Weather-Master is Digitar's top-of-the-line handheld Micro Weather Computer, designed with data acquisition, recording, and computing abilities that make it unique. The Weather-Master gives users the opportunity to create personalized weather stations. It is engineered with dozens of superior features, including computer calibration, backlighting for easy night-time viewing, and a four-way power capability that makes it completely portable and virtually invulnerable to memory loss through power interruption. Inside/outside temperatures, time and alarm, elapsed time, date, barometric pressure, hi-low registers, autoscan, special bi-directional alarms for temp A, temp B, and altitude are just some of its functions. With the optional RG-2 Rain Gauge and AN-2 Anemometer, the functions could be extended to receive daily and accumulated rainfall, wind speed, wind chill factor, and wind direction. The ALT-4 suggested retail price is $170. For more information write to *Magnaphase Industries, Inc., 1502 Pike Street NW, Auburn WA 98001; 800-322-1502.* Or circle Reader Service number 203.



DIGITAL RADIO SYSTEMS, INC

The first DRSI PC*Packet Adapter (PCPA) is a compact, dual-port communications adapter card that plugs into an IBM or compatible. It is suitable for Packet Radio, RTTY and AMTOR applications, and has an on-board 1200 baud modem for standard VHF/UHF FM operations. This modem connects directly to the radio through a DB-9 connector. The second port may be configured for either RS-232 or TTL level outputs. It connects via RS-232 to the DRSI HF*Modem, providing a complete HF/VHF/UHF packet radio station. When configured for TTL levels, the second port can connect directly to a high-speed RF modem. Internally, the PCPA uses an 8530 Serial Communications Controller running at 4.9152 MHz. It has flexible addressing and interrupt provisions. A programmable on-board clock/timer generates a separate interrupt for protocol timing and control. *DRSI, 2065 Range Road, Clearwater FL 34625; Tel. 813-461-0204. TLX 910-250-4542 DRSI. FAX 813-447-4369.* Or circle Reader Service number 211.



AMERICAN RELIANCE

American Reliance announces its advanced AR-80LM Logic Monitor. It is a state-of-the-art design and uses innovative custom-IC construction. The AR-80LM brings high-end performance within reach of the average user. It is designed to provide automatic detection of both power and ground pins, making instrument usage an easy, clip-on-and-view operation. Additionally, the unit automatically detects both TTL and CMOS logic levels.

The AR-80LM provides indications for logic high, low, and even pulsing inputs. The unit can be used with circuit clock rates up to 40 MHz. The AR-80LM has a suggested price of $79, which includes a storage case and operator's manual. *ARI Media, 9241 E. Valley Boulevard, Suite 201, Rosemead CA 91770; 818-287-8400.* Or circle Reader Service number 202.

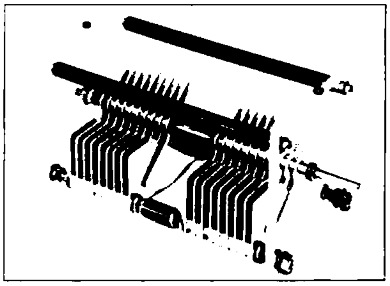
GORDON WEST'S RADIO SCHOOL

Gordon West's Radio School offers cassette theory courses for the following amateur radio license categories: Novice, Technician, General, Tech/General, Advanced, and Extra.

Each course features the latest question pool that parallels the VEC-administered examination. The cassette training courses may be used without any visual aids, if necessary, but a textbook is included. Correct answers are explained, and the radio sounds behind those answers, such as RTTY and 1200 baud packet, are played on the tape. Each cassette course with textbook is $19.95 plus $2.50 postage and handling when ordered directly from Radio School. Participating amateur radio dealers also carry these courses in stock. For more information, write or call *Gordon West Radio School, 2414 College Drive, Costa Mesa CA 92626, 714-549-5000.* Or circle Reader Service number 206.

KASARA MICROSYSTEMS

Kasara Microsystems, Inc., announces a new heavy-duty C-64 Commodore replacement power supply especially for the packet radio amateur. The amperage output now allows 24-hour continuous packet operation without voltage change or failure. This power supply also has a heavier heat sink and is an exact physical replacement for the original unit. Over 52% of Commodore 64 power failures can be directly related to the original power supply. Price is $27.95 plus $3 UPS shipping. Order from *Kasara Microsystems, Inc., 33 Murray Hill Drive, Spring Valley NY 10977, 800-248-2983 or 914-356-3131.* Or circle Reader Service number 207.

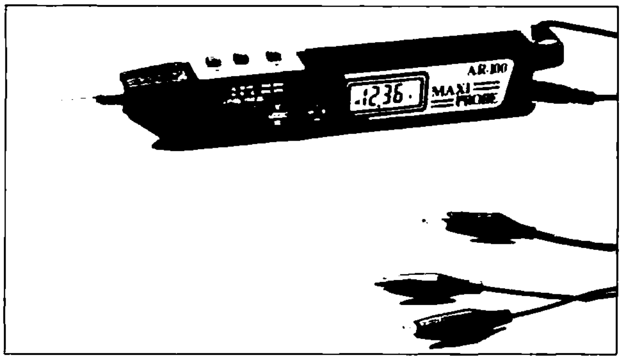


KILO-TEC

Kilo-Tec now has high quality variable capacitors rated for RF voltages up to 7.8 kV. The devices utilize heavy-duty quality brass and ultra high-grade aluminum construction with gold anodizing and high voltage acrylic. These capacitors are suitable for high-power antenna matching units, power amplifiers, and transmitters. They are presently available in two values, 500pF and 250pF. The TC-250 retails for approximately $29 and the TC-500 for approximately $40. To order or receive a quote, write or call *Kilo-Tec, PO Box 1001, Oak View CA 93022; 805-646-9645.* Or circle Reader Service number 204.

AF SYSTEMS

AF Systems describes its SEEKER Computer-Aided Communications Monitoring system as a two-part system for computer control of shortwave communications. SEEKER-LOG helps manage large databases of frequencies, and the receiver will scan the LOG for information the user wishes to record. The SEEKER radio control program will operate the receiver automatically in the user's absence, and can be programmed to record 100 weekly transmissions. SEEKER also features a menu of 26 international and other scheduled broadcasts, indicating those currently on the air. SEEKER is available for Commodore 64/128 computers and ICOM IC-R71A/E communications receivers. A demonstration package of the SEEKER system is available for $15. The suggested retail price for the complete system is $219. Free brochures. *AF Systems, P.O. Box 9145, Waukegan IL 60079; Tel. 312-623-4744. Compuserve E-Mail: 71310,3712.* Or circle Reader Service number 214.

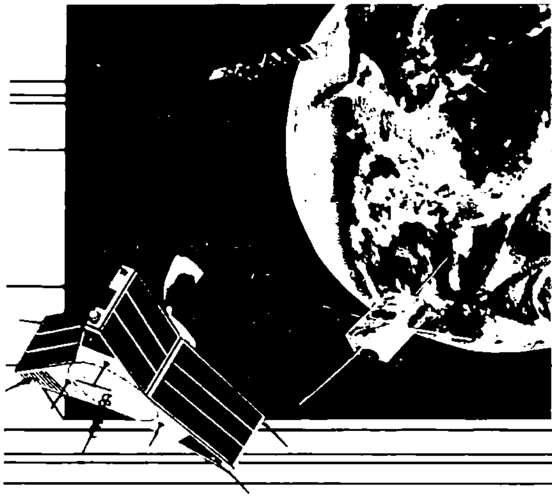


AMERICAN RELIANCE

The new AR-100 Maxi-Probe from American Reliance is three instruments in one: An autoranging DMM that measures DC or AC voltage and resistance. It is also a logic probe that works with both TTL and CMOS logic at up to 10 MHz and an audible continuity checker. The Maxi-Probe may be used with screw-on accessory tips, such as alligator and spring-hook types. The data hold feature allows users to capture and hold a voltage or resistance measurement in hard-to-reach areas. The unit also has a diode test for reading the forward voltage drop of a rectifier and a removable ground lead to further expand versatility and ease storage requirements. The Maxi-Probe comes with an alligator clip ground lead, a set of logic test leads, a carrying case, and the operator's manual. The suggested retail price is $64.95. *ARI, 9241 E. Valley Blvd., Suite 201, Rosemead CA 91770. 818-287-8400.* Or circle Reader Service number 208.

COMPUMAX

Compumax introduces its TRUFAX system, a plug-in board and software for IBM computers and compatibles, that enables the user to capture and transmit facsimile image data on either AM or FM radio facsimile. TRUFAX is compatible with the Hercules, IBM color graphics (CGA), Microsoft Paintbrush, and enhanced graphics (EGA) adapters. The TRUFAX software allows the operator to zoom and pan the entire image. Depending on the graphics adapter used, the user will actually see two colors (black and white) on a Hercules compatible graphics adapter, and up to 4 levels of gray and 4 colors on the enhanced graphics adapter. With the proper transmission equipment, the user can transmit the image at a maximum rate of 4 kHz. The TRUFAX board accepts an audio waveform in the voltage range of 0.75V to 5V peak to peak. The output level is 1V peak-to-peak. The price for the TRUFAX system, including an IBM PC compatible plug-in board and software, is $599. There is a two-year warranty on the hardware, and the software will be maintained by Compumax for 90 days, with an optional two-year maintenance agreement available for $75. For further information, contact *Mr. Robert McKenna, TRUFAX Marketing Manager, Compumax Corporation, 26 West Boylston Street, West Boylston MA 01583; 617-835-2722.* Or circle Reader Service number 209.



History of Project OSCAR

Once upon a time . . . .

by Chuck Towns K6LFH

The Beginning of Project OSCAR

Project OSCAR began in my home when Fred Hicks and his wife were visiting in the late 1950s. Fred and I, two Lockheed hams, started regular lunch meetings to discuss the topic of amateur radio in space, which soon hooked many other hams.

The name of the project came from Don Stoner when he was hamming with Fred Hicks. Don had tossed the name out in his column in *CQ* when he wrote about what hams could do if "someone had a spare (rocket) booster." Fred is the one who envisioned a Lockheed Agena ride.

The available battery power and solar cells then cost hundreds of dollars each. They were limited at best, and a call to use as a satellite ID could not have dashes and could only have a few dots. W6EE was an open call, so we did our best, and got it! We concurrently applied for W6EE/S for Space, and it was also granted. We used neither in space, however, but only on QSL cards.

Where else could a project like this go on with total acceptance besides in the San Francisco Bay area (soon to become Silicon Valley)? We addressed the feasibility of OSCAR in the OSCAR White Paper, published in March 1961. Among other things, the paper outlined a simple method to monitor the satellite's temperature—just count the time it takes to hear 10 complete His from the bird. The warmer the satellite, the more quickly it sent the HIs.

Down To Business

The goal was set to place an amateur satellite in space, so now we had to attend to the details. What frequency and mode to use? The group finally chose CW in the lower 2 meter band, since most countries had these allocations.

Each facet of this challenge had to be put into an international arena, and the books on frequencies and their assignments had to be tackled. We lucked out again, because one of the men on the fringe of our group specialized in frequency management. He was cornered when he wasn't looking, and we had a volunteer to certify our chosen frequency of 145 MHz.

Besides myself as Chairman and Fred Hicks W6EJU as Field Operations Manager, the following men made up the original Board of Directors: Jerre Crosier W6IGE, Club Coordinator, Harley Gabrielson W6HEK, data handling, Harry Engwicht W6HC, ARRL Coordinator, Nick Marshall W6OLO as the Engineering Manager, Stan Benson K6CBK, Planning, Don Stoner W6TNS, Project Design Manager, Bill Orr W6SAI, Publicity, Tom Lott VE2AGF/W6, Communications Manager, Milt Caston WA6MSO, Advisor, Harry Workman K6JTC, Secretary, Dick Esneault W4IJC/6, Treasurer, and Bernie Barrick W6OON, Procurement.

The men working with Nick W6OLO, the engineering manager, now had to design an oscillator to function at least at 72.5 MHz for doubling to 145 MHz. (In 1960 solid-state circuitry wasn't available!)

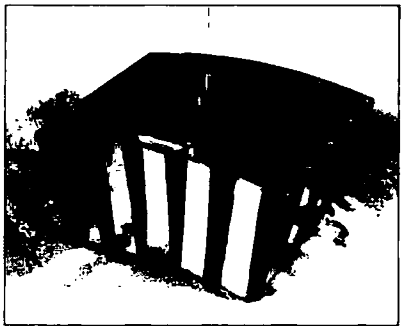


Photo A. OSCAR 1—the world's first non-governmental communications satellite.

My first task was to get Lockheed approval to study a typical Agena spacecraft to determine where our 10 pound sub-spacecraft could fit. Since Lockheed was building the rocket for the Air Force, I prepared for a trip to the Capitol. Bill Orr W6SAI and I got together to draw up a White Paper to define our needs and goals before going to Washington, DC. While Bill concentrated on the paper, I worked out a schedule with George Jacobs W3ASK of various hams in the Washington community who could promote our cause. In early fall of 1961, about a year after I'd joined Lockheed, we seemed to have all of our pieces assembled and ready to go.

My biggest task was presenting the OSCAR concept to various radio clubs and technical organizations in the area. Our group always needed volunteers to keep the ball rolling. As other technical groups became enthralled with our progress, my speaking schedule was jammed even before the launch. Our mailing list and participants grew. From September through October, hints of a Washington approval looked very good. The outer satellite housing was completed. The shake, rattle and roll tests went well, and the radio frequency study and evaluation for possible interference with the Agena vehicle were completed. In fact, in October, Bill Orr and I were requested to speak at an Air Force Radio Club in Maryland, where we planned to announce the approval for our launch. Everyone at the meeting was awaiting the good news when we were advised that the approval had been delayed. Bill and I had nothing to tell them.

Nevertheless, interest was piqued, and my speaking assignments grew almost out of reason. One question always asked at the end of these talks was, "What's down the line?" I spoke of higher frequencies, multi-frequencies, SHF beacons, and intersatellite communications. This was all blue-sky 25 years ago—but all since accomplished!

Lady Luck

OSCAR was the first nongovernmental, nonmilitary, and noncommercial satellite. It was up well before the multi-million dollar Telstar. Much of this is due to perseverance, and being in the right place at the right time.

It really seems as though there was a Guiding Spirit along with us on this venture. Whenever we needed a special part, it showed up almost as soon as the need was known. One time while riding in a hotel elevator in Washington DC, three fellows got on and start talking about the OSCAR concept. We ended up having dinner together, and I ended up with three good friends, one of whom was very helpful with OSCAR 2. Another time a nice gentleman was sitting next to me on a flight back from a few busy days in the Pentagon. I finished my notes and, as I put them away, one of my copies of the OSCAR White Paper fell on the seat between us. It was immediately spotted for what it was, and my new friend was Finley Carter K6GT, President of Stanford Research Institute. He

was an OSCAR member before we landed, and Chairman of our Board of Directors by the end of the year. Were these coincidences? That word doesn't explain such propitious events, occurring one after another.

Both the military and the State Department were involved, thoroughly investigating all of the ramifications of our project. They were especially concerned with who would pay for the damage that might occur if, on reentry, the bird crashed into an airplane or hit someone on the ground.

Up and Away!

The launch was a great shot. I have been involved with rocketry and satellites since 1945, and I will always stand in awe at a blastoff. This, of course, was a special one and I was really more excited and emotionally involved than I'd realized. I was told that I was crying with tears running off my chin. Those of us at the launch didn't get the word that our special tracking station on the South Pole had heard OSCAR thirty or so minutes after launch. We were at the airport to fly back to San Jose and our headquarters and tracking station in Sunnyvale. We got the word of the success of OSCAR from the pilot while we were flying. The tears started all over again.

I put high on this memory list the unquestioned support of every commercial concern with which we were involved. First, we got the word out to every company that had a radio club to supply volunteers from any source, before and after the launch other organizations, not just Lockheed. This move worked very well. Three or four of our active crew weren't even licensed.

Shortly after the first launch, it soon became clear that we needed new Headquarters. We no sooner started discussing this when Bob Smithwick W6JZU, Chairman of the Board of Regents of Foothill College in Los Altos, came to advise that we would be welcome on their campus and that they had an extra building on their campus that might meet our needs. Most of us knew Bob well, and he had been behind us on every step we take. We are proud to have him as an OSCAR participant. He recently sponsored an Electronic Museum on campus that will include and display the Project OSCAR archives.

OSCAR 2

The significant change for this bird was in the shape and type of temperature-control stripping on the external surface of the satellite. OSCAR 1 had a few wide stripes, 2 had more stripes with a different pattern. Whoever monitored OSCAR 2 could learn this from the temperature readings plotted from the time interval of 10 HIs.

The first two OSCARS were ejected from the parent Agena satellite with a very simple hooking device powered by a compression spring bought from Sears & Roebuck for $1.15. Lance Ginner K6GSJ conceived this. We were the first auxiliary package to eject from the parent and go our own way. This sparked other groups, such as science organizations and universities, to put up their own

Photo B. OSCAR 2. Note the difference in the external stripping from OSCAR 1. Chuck K6FLH is holding the bird.

devices. Where do you think the Air Force sent them for advice? We were more than happy to help.

OSCAR 3

A synchronous satellite was next. Our OSCAR 3, and AMSAT's OSCAR 8, were both planned for a synchronous orbit 23,000 miles above the Earth. Our launch vehicle lost its last boost rocket and the remaining orbit varied from 100 to 23,000 miles. Because OSCAR turns on at ejection from parent, enough tracking data was logged to be able to predict its new path. We then supplied this data to aid others to turn on their packages. With OSCAR 8, the booster blew up, and that was it.

OSCAR 3 was the first repeater satellite, and it was in and out on 2 meters. Lance Ginner K6GSJ, Ed Hilton W6VKP, and Don Norgaard W6VMH were the principal conceivers of this satellite configuration. It worked well and made possibly 1000 contacts in 22 countries. It only lasted 18 days, because adequate solar cells were beyond our pocketbooks. It proved, however, the practicality of Amateur Radio in two-way communication in space.

As OSCAR 3 neared completion, the West Coast crew was slowly burning out. Five years of creative, serious, and time-consuming activities were starting to take their toll, and fewer than 25 hams remained on the working crew.

TRW Into The Act

At this time, however, another very rare opportunity arose to send a bird into synchronous orbit aboard a Titan 3-C rocket. The Project OSCAR Association had contacted several technically capable ham radio groups, and one of these, the TRW Radio Club of Redondo Beach, California, felt they could meet the technical and time demands of this once-in-a-lifetime offer! OSCAR had already spent over a year developing OSCAR 3, and were not quite finished with it. We couldn't single-handedly complete 3 and create 4.

The TRW folks completed an excellent space package. During the launch, however, the last booster rocket failed, resulting in a highly elliptical orbit.

A satellite destined for a synchronous orbit about 22,000 miles above the earth requires three, serially fired, booster stages of rocket energy. The first rocket engine burn sets the satellite off the ground and into a parking orbit 100 or so miles above the earth. A third rocket booster ignites, and it turns the satellite in the direction desired around the earth to fulfill its signaling function as it accelerates the satellite to its orbital velocity. As noted, the third burn rocket failed to function and the satellite actually fell back to the altitude and dimension of its parking orbit. The velocity, however, had built up tremendously from this fall so it made a quick curve around the earth and shot out to 22,000 miles again.

OSCAR 5

Our space launching contacts said that there were many others standing by for a launch opportunity and even noted that some had duplicated our technical know-how so their satellites should qualify. We couldn't complain, they had been most fair and helpful. The OSCAR group was again approaching burn-out, but again our Guiding Light led Perry Klein W3PK and Jan King W3GEY to us. They are two of the original members of AMSAT. They visited us for two or three days, and we found a housing that could accommodate their OSCAR 5.

Project OSCAR in the Last Two Years

Our Board of Directors meeting retained John Pronko W6SN as Chairman, and elected Jim Eagleson as President, Paul Shuch as Technical Director of User Services, a new title for this year.

Jim Eagleson continued to explore the possibilities of Amplitude Compandored Sideband (ACSSB) and began looking into the possibilities of a Community Access System for future OSCARs.

Ross Forbes developed a working relationship with AMSAT-UK and AMSAT-AUSTRALIA to make software packages they developed available to users in North America. Project OSCAR also began to help organize all-day mini-conventions aimed at helping the new satellite user to get started on OSCAR.

Working with AMSAT-NA, Project OSCAR instituted a weekly VHF net to help those in Central California receive timely OSCAR information. This net is broadcast on WA6YCZ/R (147.15 MHz +600) and is held each Tuesday evening at 8 PM local time. WA6YCZ is one of the early San Francisco Bay Area repeaters, and was established by a few of the original members of Project OSCAR and the past and present licensee is Lange Ginner K6GSJ. In addition to WA6YCZ, the net is rebroadcast on K6GW3/R, 443.525 and WA6SYE/R, 443.525 (in Central Valley). At times, the Project OSCAR net is simulcast on 3.840 MHz to supplement the weekly AMSAT-NA

75 meter net. If other VHF and UHF organizations are interested in linking into the net, please contact Project OSCAR at our Post Office Box.

Quarter Century in Space

December 12, 1986 was the 25th Anniversary of the launch of OSCAR 1, a celebration was held at Foothill Community College to recognize those involved in the first program. Most of the original teams attended and many had not seen each other for many years. To honor the occasion, the OSCAR-AMSAT Archives was officially formed, and the Bud Shultz W6CG Award was created. This award was established to recognize individuals who make important contributions to the OSCAR program. The award is to be given on an annual basis at the annual meeting of the California VHF/UHF Meeting. Get complete details of this award by sending an SASE to Project OSCAR and to the attention of Paul Shuch N6TS.

Project OSCAR in 1987

Dr. Robert Smithwick W6JZU returned to the board. Smitty was primarily responsible for moving Project OSCAR to the permanent home on the campus of Foothill Community College in Los Altos Hills. The annual Board of Directors meeting is held at the Electronics Museum operated by the college, and the OSCAR-AMSAT Archives are now kept by the same museum.

This year saw continued support for the VHF net, and continued sales of software. Project OSCAR continues to sell satellite tracking software written by James Miller G3RUH. This program is available for the Apple II, IBM-PC, TRS-80 (Model I/III) and the Commodore C-64/C-128. Cost is approximately $25 per disk, but those interested should send an SASE to Project OSCAR for detailed information. *Project OSCAR, PO Box 1136, Los Altos CA 94023-1136.*

Project OSCAR in 1988

At the annual Board of Directors meeting, Gary Nakayama KH6JARB and Jeffrey Pawlan WA6KBL joined the Board of Directors. Chuck Towns K6LFH and Lance Ginner K6GSJ are still very active on the Board of Directors. New officers are:

Chairman of the Board—Paul Shuch N6TX
President—Ross Forbes WB6GFJ
Secretary—Nick Marshall W6OLO
Treasurer—Gil Morris WB6KCJ
Director of User Services—Gary Nakayama KH6JRB
Technical Director—Jeffrey Pawlan WA6KBL

Recently, the board met to review and update the by-laws so we are in compliance with present regulations. This also allowed us to bring everything in line with the operation of the corporation. Most important was the establishment of an Executive Committee to oversee the daily operations. Members of the Executive Committee are N6TX, WB6GFJ, WA6KBL, W6NBI, and KH6JRB.

With the launch of Phase 3C, Project OSCAR will be adding to the software library available for sale. All funds received go toward operating the organization and for contributions to the various AMSAT organizations. New software will include SAT-SCAN for the IBM-PC developed by AMSAT-UK, and a suit of programs written by James Miller G3RUH to help the intermediate OSCAR user understand more about the elements affecting the spacecraft. Project OSCAR will also have the decoding software developed by G3RUH and Markel Bertilsson SM5REY to read the PSK telemetry and messages contained on Phase 3C. This software works with the G3RUH Oscar-10 PSK Modem.

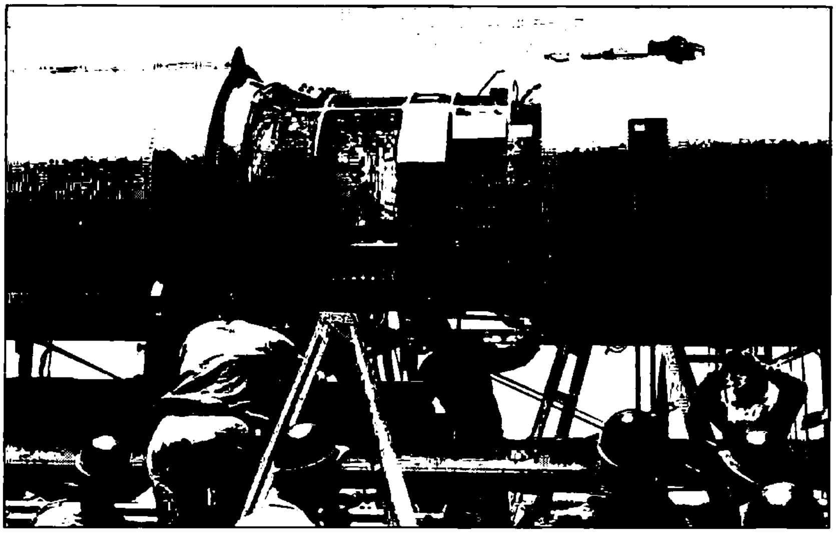


Photo C. Assembly of the launch housing on the Agena spacecraft. The top side of OSCAR 2 shows on the right side of the rack, in the exposed section of the rocket.

Project OSCAR will continue to support the many worldwide AMSAT groups. With the many complex problems facing OSCAR in the future, Project OSCAR has no intention to compete with any organization. Our interest is to promote Amateur Radio Satellites and help any way we can.

Project OSCAR provides a semi-regular newsletter to anyone who makes a $10 donation and sends six SASE business-size envelopes with 2 ounces of postage or equivalent IRCs attached.

Project OSCAR will help AMSAT-NA's Field Operations with support to produce 35mm slide programs and VHS video programs. These programs will be available through the AMSAT Field team of Regional and Area Coordinators. Contact AMSAT-NA for more information. The Project's president is also working with AMSAT-NA's president to develop a closer working relationship to promote OSCAR. We make sure that Project OSCAR is represented at the annual AMSAT-NA board meeting by sending our president each year to their meeting as an observer.

OSCAR Publications

Nick Marshall W6OLO's new book, *History of Project Oscar* is now in final review and will shortly go to print. Project OSCAR is also working on a booklet aimed at the first-time user. Presently, the section of highly elliptical orbits is completed, and we are adding material for the low earth orbit satellites UoSAT, RS, and F-O-12, along with information on Phase 3C.

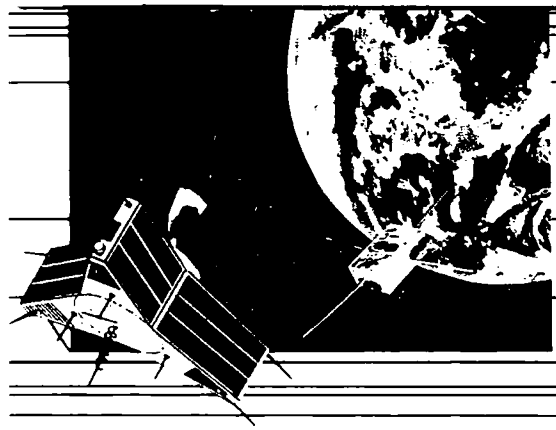
Project OSCAR also is working with AMSAT-NA Vice-President of Field Operations KO5I to produce an area coordinator's handbook. This publication will allow each AMSAT-NA area coordinator to have the necessary information to be an effective AMSAT representative in his or her area. The publication will contain details obtained from the already experienced AMSAT-NA regional and area coordinator teams.

After asking the Project OSCAR membership for their areas of expertise, we have organized a list of volunteers willing to translate OSCAR articles from various languages. Presently, we are able to translate engineering/technical Japanese, French, German, Spanish, and Hebrew into English. It is a principal goal of OSCAR to provide English translations from the foreign OSCAR users in hopes of providing better understanding among the worldwide OSCAR community.

In Closing...

Volunteer organizations need more than manpower alone. Those who can't donate time to the continuing OSCAR project may make a financial contribution to Project OSCAR and AMSAT-NA. These funds will continue to pay for technical development and postage and are tax-deductible under Section 501(c)(3) of the Internal Revenue Code.

Chuck K6LFH has been a ham since 1958, and has degrees in both Aerodynamics and Electrical Engineering. He worked for Lockheed Aircraft in Sunnyvale, California, until he "retired" in 1977. He has since started several computer businesses. Other hobbies include flying and travel.



Satellite Awards

Hamsats add a new dimension to the paper chase.

by Heather MacAllister WB5RMA

As thousands of amateurs have discovered, chasing satellites can be addicting. Many a jaded ham, with walls full of rare QSLs and the familiar DXCC, WAS, and WAC awards, has renewed his enthusiasm for amateur radio by earning those awards all over again—along with new ones—through the satellites.

Just as with the low-band awards, some of the satellite certificates are more difficult to earn than others. Here's a few of the easier ones for starters.

Get Warmed Up on These

The most basic is the Satellite Communicators' Club certificate. Just report a two-way contact through any satellite to AMSAT S.C.C. Manager, PO Box 27, Washington, DC 20044. No form is necessary. Include information about the QSO along with an SASE and $1 ($2 for non-members).

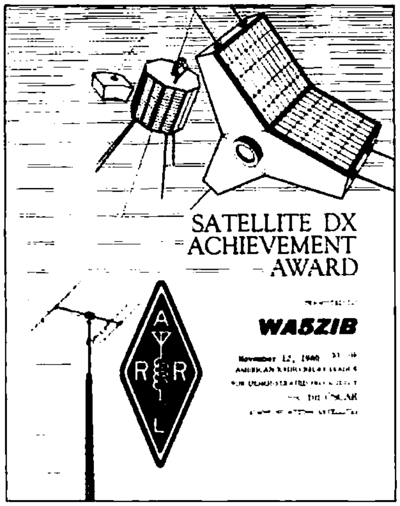
A good next-step choice is the Ten American Districts Award (TAD) with satellite endorsement. This award is sponsored by Lockheed E.R.C. Amateur Radio Club. To qualify for the award, contact all ten American callsign districts from the same callsign area. Take care to not rely on the callsign, itself—check the actual district worked. The Lockheed club prefers to see a verified list over QSL cards. The list must show all pertinent information and should have the validation of an elected official of an amateur radio club or two other licensed amateurs. Enclose $1 for the list submission, $2 for submitted and returned QSLs. Send award requests to W6LS, 2814 Empire Ave., Burbank CA 91504.

When sending QSLs, make certain that each card clearly states that the contact was by satellite. State the frequency as uplink over downlink. For example, a Mode J contact on Fuji Oscar 12 is written as 145/435 MHz. Orbit number is optional.

Ready for Tougher Challenges?

The familiar WAC, WAS and DXCC awards from the American Radio Relay League are available for satellite QSOs. For the Worked All Continents (WAC) award, submit proof of contact with a station in Africa, Asia, Europe, North America, South America and Oceania. Ask for the satellite endorsement when applying.

The rules for Worked All States (WAS) are similar to the standard WAS award. Any and all satellites may be used in contacting a station in each of the fifty states. For the complete rules and an application form, send an SASE to the American Radio Relay League, 225 Main Street, Newington, CT 06111.



For Satellite DXCC, submit one hundred QSL cards from the DXCC list of countries and forms CD-164 and CD-253 to the ARRL. When requesting the forms, please include an SASE with two units of postage.

The Satellite DX Achievement Award, DX-1000, is also sponsored by the ARRL. Its rules are a bit tricky. Qualifiers must accumulate 1000 points. Each QSO with a new station is worth 10 points, each new country is 50 points and each new continent is 250 points. The very first contact nets the operator 310 points! Submit QSLs with form CD-206 to the ARRL for this award.

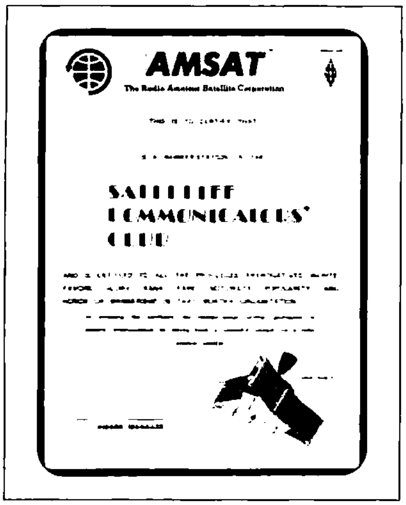
The ARRL charges no fees for these awards, but membership is required of all American and Canadian applicants.

Speaking of Canada, the Northern Alberta UHF Society sponsors an impressive-looking certificate called the VE Satellite Award. Stations inside North America (W/VE and KL7) must submit QSL cards confirming satellite contacts with eight different Canadian call areas: VE1, 2, 3, 4, 5, 6, 7, 8, 0, VO1, and VY1. Stations outside North America, including KH6, are required to contact just four call areas. The application fee is $1 for W/VE and KL7 stations or four IRCs (International Reply Coupons) for others. Those who wish to have their cards and award sent by registered mail must include extra postage. Send award requests to Ray J. Nadeau VE6SF, Committee Chairman, PO Box 52, Barrhead, Alberta T0G 0E0, Canada.

An award with a slightly different emphasis is the K2ZRO Memorial Station Engineering Award, honoring Kaz Desker, sponsored by the Radio Amateur Satellite Corporation. This is a test of operating skill and equipment performance. A control station sends and repeats numeric code groups at gradually reduced power levels. The operator measures the receive sensitivity of his satellite station as he monitors and records the content of the transmissions. Those who can copy the satellite's beacon can qualify for the basic award. The fun comes from pursuing endorsement stickers for the different power levels with the top award being for perfect copy at the lowest power level. AMSAT hopes to encourage stations to improve their downlink reception and thus reduce uplink excesses which are unnecessary and drain the satellites' batteries. Unfortunately, because of the deterioration of AMSAT Oscar 10, this competition is on hold until the launch of Phase 3C. For operating times and frequencies, send an SASE to AMSAT ZRO Test, PO Box 177, Warwick, NY 10990. The cost of the basic award is $3.50 for members and $5 for non-members.

AMSAT sponsors three other awards. They are the AMSAT OSCAR Award, the OSCAR Sexagesimal Award and the OSCAR Century Award. They are presented for 20, 60 and 100 qualified contacts, respectively. A qualified QSO is one in a different state, Canadian call area or DXCC country, in any combination. Endorsements for each 10 QSOs between levels are available. Again, the cost of the award is $3.50 for AMSAT members and $5 for non-members. Include QSL cards and return postage. Send to AMSAT, PO Box 27, Washington, DC 20044.

Two challenging awards are the CQ CW DX Award with OSCAR endorsement and the CQ SSB DX Award with OSCAR endorsement sponsored by *CQ Magazine*. The basic award is for confirmed contact with 100 countries specifically by CW or SSB After the basic award, *CQ* sponsors several endorsements, including one for 50 or more countries confirmed via satellite. After the basic award is issued, CQ requires only a listing of confirmed QSO's for the endorsement. To get the fee schedules, proper forms



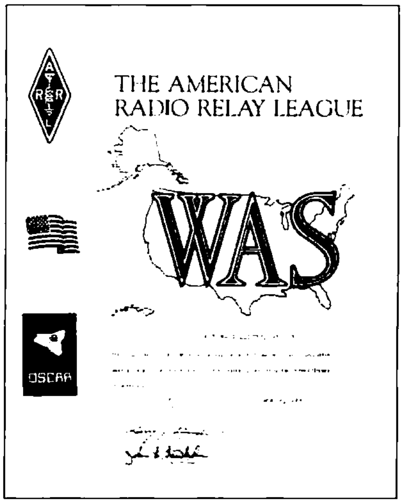
and full awards requirements, request the CQ DX rules sheet from CQ Magazine, 76 North Broadway, Hicksville, NY 11801.

Our own *73 Magazine* offers the DX Dynasty Award. The basic award is for 100 countries worked with endorsements available in increments of fifty up to 350, then at 375 and 400. Only contacts made after 0001Z on January 1, 1987, are eligible. It isn't necessary to submit QSL cards, but it is necessary to apply on an official DXD form, available from *73 Magazine*. For the form and a countries list, send an SASE to WGE Center, Peterborough, NH 03458, Attention DXDA. Contacts should be listed in callsign order, with date, time, frequency or band, mode, and power. The fee is $6 and each endorsement is $2, with the exception of endorsements requested on the first application—they're free.

Countries besides Canada and the United States also promote some awards. South Africa AMSAT sponsors the Satellite Communication Achievement Award for making twenty-five two-way contacts through Phase 2-type satellites. Presently, these are RS 10-11 and Fuji Oscar 12. Oscar 10 contacts are not included, since it is a Phase 3 award.

The award is available from AMSAT SA, Box 13273, Northmead 1511, Republic of South Africa, but funds must be remitted in Rands. An easier way is to request it through AMSAT NA and use dollars. The certificate will still be signed by SA Awards Manager, Andre Botes, ZR2FK. Send requests to AMSAT, P.O. Box 27, Washington, DC 20044. Cost is $3.50 for members, $5 for non-members (of AMSAT NA).

From time to time, the Federation of Radiosport in the USSR sponsors a very intriguing competition via the RS satellites. Details are sporadic and aren't usually broadcast very far in advance of the actual contest. Listen to the AMSAT nets for advance warning, or try sending four IRC's to the Federation of Radiosport, Box 88, Moscow, USSR, with a request for information. In the past, the contests have lasted a few days, with the objective being to work as many different stations as possible during the period. A typical exchange consists of the contact serial number and signal report. Contest logs



should be sent to the Federation of Radiosport, Box 88, Moscow USSR. Certificates are given for first-, second- and third-place winners in each continent. They are written completely in Russian and are guaranteed eye-catchers.

These are the major awards for satellite-chasers. Earning them tests equipment and operating proficiency, as well as luck. Clear some wall space and good hunting!

Heather MacAllister is XYL of our hamsat columnist Andy. We welcome her contribution and look forward to more submissions in the future. She can be reached at 2310 Romayor Court, Pearland TX 77581.

Briefly Speaking:

The Hardly-Hard, Hardline Connection.

by W. Max Adams W5PFG

Tornadoes and hams often work for each other. Hams track and report severe weather, capable of producing tornadoes. Tornadoes can tear down commercial radio towers, producing short but usable sections of hard-line (rigid) coaxial cable.

Recently a Texas tornado completely lowered a 360 foot commercial two way radio and paging service tower. This produced (after the insurance company said, "Get rid of it!") a 150-foot roll of ⅞-inch hardline in my front yard. There are several kinks and abrasions, but so-what? I only need four pieces, two 20-foot and two 40-foot coax sections for my proposed fold-over tower's VHF/UHF antenna.

Now, let's see. Four sections, with two connectors per section; gotta get me eight ⅞-inch hardline connectors. Then came the eye opener; only $50 per connector times eight equals $400! Before I had a black eye closure from a usually benevolent XYL, I skillfully dodged the blemish by saying, "Ho-Kay, Ho-Kay, I gonna home-brew one and Iff-en it work, I'll home-brew seven more!"

My sharpest dull hack saw blade removed one kinked-up part and left a good six-inches of long home brewing prototype sample.

The same "150-foot roll in the front yard" remark was repeated about 6 times 400 divided by 150 (there were six 400-foot hardline runs up the same ill-fated 360-foot tower) times, by other area hams. Most were either thinking the black-eye blemish remark, or making the blemish avoidance remark, "I-gonna home-brew-em!"

Homebrewing hard line connectors is not a new project. I have seen several articles on the subject; I'm just gonna "wing-it" on my own, and see what happens.

Several "why-not" questions came to mind while cleaning-up, squaring up and smooting up the six inch hardline sample:

"Why not use commonly available material, so others can easily make their own connectors?"

"Why not simplify the procedure for use of ordinary hand tools?"

"Why not minimize soldering, yet maintain good electrical connection?"

"Why not strive for good mechanical construction, which can later be waterproofed?"

"Why not use an inexpensive mechanical arrangement, yet consider electrical requirements, such as, characteristic impedance mismatch, etc.?"

"Why not use a mechanical arrangement which will allow preventive and corrective maintenance?"

"Why not strip 1-½ inch of the sample's outer conductor plastic jacket and see what it is covering?"

"Why not remove 1.1 inches of the corrugated outer conductor and foam insulation thereby exposing the 0.3-inch tubular center conductor?"

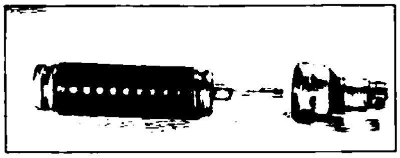


Photo A. Interior detail of the home-brewed hardline connector. At $50 each for regular connectors, it's worth the effort to roll your own.

"Why not take the stripped sample to the hardware store and search for a suitable rigid copper plumbing fitting that will reduce the ⅞-inch hardline to a female UHF barrel connector?"

Under five watchful eyes of three hardware store clerks, I fumbled through several bins of pipe fittings. I tried to prove my sanity to these same three clerks with the purchase of one, 79-cent, 1-inch male pipe thread to ½-inch rigid copper pipe adapter.

Standard water pipe threads are slightly tapered. Likewise, the copper fitting's threads are tapered. I used a ⅜-inch round burr electric drill bit, a sharp edged ½-inch mill bastard file and a pocket knife to remove the taper and some of the threads from the copper fitting. I tested the fit frequently during this surgical exercise to determine the seating of the outer conductor to the hardline adapter shell.

Notice the corrugated "lands" pressed in the hardline's outer conductor. Remove sufficient adapter shell material to allow insertion of one and one-half "high" lands; about 0.4 inches. This places the first "low" land about 0.1 inch "inside" the adapter shell.

"Why not drill and tap three, equally spaced, 6-32 thread Allen setscrew places, 0.1 inch from the adapter shells rear edge?"

This should mechanically secure the hardline to the adapter shell and provide a good electrical (although not waterproof) connection.

Assorted UHF chassis connectors, barrel connectors and adapters were scrounged from the connector junk box. I carefully examined the assembly of each: "What had to go together, can come un-together!" A lightly chrome-plated brass BNC male to UHF female adapter seemed a likely candidate for hacksaw surgery. Make a shallow cut, next to the unthreaded shoulder portion of the UHF end. Be careful, do not cut the center conductor.

"Why not remove the chrome plating from the smooth rear edge of the UHF shell?" A few strokes, with a flat file, quickly removes the not-so-tender chrome plating. Later, this allows soft soldering of the brass UHF shell to the copper adapter shell.

"Why not taper the hardline's 0.3 inch tubular center conductor to approximate the hardline adapter shell taper?" This is accomplished by sawing four ¾-inch slots in the center conductor with two hacksaw cuts spaced 90 degrees, leaving four center conductor tabs.

"Why not cut a taper to each center conductor tab, which allows them to form about the UHF adapter's center conductor?" Carefully bend each tab to provide equal reduction of the hardline center conductor. Trim the four formed tabs, setting the center conductor overall length to completely seat in the UHF shell insulator. Leave sufficient clearance for self alignment during installation of a PL-259 connector.

Notice that the center conductor's insulator is held in place by three "staked" indentations in the UHF shell.

"Why not remove the UHF insulator?" A few sharp blows to a suitable drift punch while holding the UHF shell forces the insulator from it's mounting. This prevents its distortion when the UHF connector shell is soldered to the hardline adapter shell.

Carefully assemble the hardline, adapter shell, UHF shell, insulator, and center conductor. Inspect the assembly for alignment and neatness. Carefully mark the location of the UHF shell. When it is correctly installed in the hardline adapter shell, then separate the entire assembly.

Remove the UHF insulator, as described earlier. Install the UHF shell in the hardline adapter shell at its marked location. Apply a small amount of rosin-core solder, using a 150-watt soldering gun, between the UHF

connector and the hardline adapter shell. Heat the surfaces to soldering temperature, then flow a small bead of rosin-core solder to the joined parts. Allow the assembly to cool naturally. Do not pick it up too soon, as I did—for a very short time!

Carefully solder the UHF center conductor to the hardline center conductor tabs. Allow the solder to flow smoothly and cool naturally. Do not attempt to quench (cool) the connection, otherwise the solder may crystallize and/or distort the assembly.

"Why not place a neat amount of silicon seal around the exposed hardline outer conductor?" This may not make the joint watertight, but it can offer a little help with a potential moisture problem. Carefully install the hardline shell assembly to the center conductor assembly and snugly tighten it's three set screws. Do not puncture the hardline outer conductor.

"Why not get a cup of coffee and admire the newly completed hardly-hard, hardline connection?" It's a lot of fun to install a PL-259 on your proud home-brew accomplishment while waiting for the next cup to cool!

Somewhere near the bottom of the pot, another why-not question was found near the bottom of the cup.

"Why not repeat the procedure and make a pair of connectors, this time using a 20 foot section of hardline?"

"Why not get a cup of coffee and admire the newly completed hardly-hard, hardline connections?" It's a lot of fun to install a PL-259 on your proud home-brew accomplishment, while waiting for the next cup to cool!

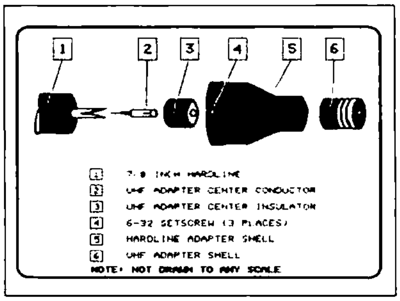


Figure 1. Hardly-Hard hardline connector assembly component parts.

Somewhere near the bottom of the second pot, another why-not question was found near the bottom of the fifteenth cup.

"Why not make some simple measurements, if for nothing else, just to "prove the books correct?" Measuring line loss in less than 100 feet of 7/8 inch hardline is not an easy task. However, some data can be obtained with a calibrated signal source, a calibrated wide bandpass radio frequency (RF) voltmeter (or wattmeter) and a dummy load of correct impedance and power dissipation.

Provided there is no system reactance, which is virtually impossible, ordinary amateur radio test equipment can be used to make good, valid measurements. If the GOESINTA nearly equals GOESOUTA and reflected power hardly lifts the needle from the peg, then all is OK. Should there be any appreciable line loss, reflected power indications, or heating of the joints, something is wrong! Incidentally, use of an antenna system, thought to be of 50Ω impedance, a 50Ω (nominal) RF source (Transceiver or transmitter), 50Ω (Nominal) hardline and 50Ω (Nominal) test equipment, will be reactive to some degree. Therefore, do not get on the local repeater and say, "Absolutely Flat!" without "for ham radio purposes" appended to the "flat" remark.

Briefly Speaking, readers may ask, "Why 20- and 40-foot sections of 7/8-inch hardline?" My main reason: to remove the unnatural kinks, skuffs and flat anomalies installed at several places in 150 feet of almost new, expensive coaxial cable, when the tower was disassembled by a Texas tornado! My second reason: to provide an ordinary flexible coaxial cable, flexible hardline "joint" on a fold over antenna "pole." After all, the price I paid for 148 feet of usable 7/8-inch hardline was far less than flea-market price of used RG-58!

Final reason: Think of the fun I have writing this stuff, taking pictures, drawing drawings and listening to an Editor laff-out-loud while saying, "Pee-eFf-Gee wants me to print this? Iff-en I do, wha-wud-ole 'NSD' say?" "Yer-fired!" thasa-wha-e-wud-sa!" Vy 73's, Max. ■

Number 11 on your Feedback card

Uncle Wayne's Hamshack Sweepstakes Winners

These are the lucky winners of Uncle Wayne's hamshack!

Hooray! Hooray!

Grand Prize
Louis Hahn WB3KVH from Erie, Pennsylvania, won an IC-551D six-meter transceiver and an IC-451A 70cm transceiver.

Second Place
James Jones from Birmingham, Alabama, won an IC-451.

Third Place
Sylvester Haefner from Mystic, Connecticut, won an IC-551D.

Fourth Place
David Brockelmeyer KI0V from Ballwin, Missouri, won an IC-490A.

Fifth Place
Charles Sadowski, Jr. from Glendale, Arizona, won a Kenwood TR-9500 UHF multi-mode transceiver.

Sixth Place
Malcolm Mayercik W2TI from High Bridge, New Jersey, won an ICOM PS-3 power supply.

Seventh Place
Francis Gracon from Englishtown, New Jersey, also won a PS-3.

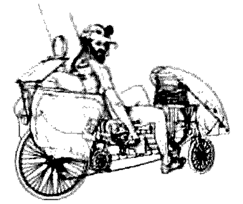
Eighth Place
Ted Pinsker KA3COR from Pittsburgh, Pennsylvania, won a Yaesu Dummy Load-Wattmeter.

Congratulation to all the winners from everyone here at 73!

The Winnebiko's Solar Power System

Part 4 in the tech nomad series.

by Steven K. Roberts and Glenn Glassner



From the perspective of a sandy towel on a Key West beach, there is something abstract and remote about magazine publishers and deadlines. The attitude of mañana pervades the island air like the fragrance of frangipani, rendering the daily realities of business about as substantial as stray radio waves...editors notwithstanding.

But there's nothing at all abstract about the sunlight down here in paradise—which is a good thing for both the bikini-clad spring-break beach crowd and the power-hungry Winnebiko. Free electricity, and lots of it, keeps my systems happy, unconcerned with noisy island power lines or the grim problems of dead batteries in the wilderness.

In this, the fourth article of our series, I'd like to talk about the bike's power-management circuitry. Starting with the solar panels that take it in and ending with the switching power supplies that put it out. The whole system is designed to provide maximum independence and efficiency. The resulting ideas can be applied to a wide variety of mobile, portable, and field-day systems.

Solar Panels and Batteries

The bike carries a pair of Solarex SX-10 LITE photovoltaic modules, each weighing in at less than 2 pounds and producing a steady 650–700 mA into an associated 12-volt battery when the sun shines. These rugged 12 X 17-inch units, based on semicrystalline silicon technology and lacking the traditional heavy glass cover plates and aluminum frames, have finally rendered photovoltaic use as easy as it should be: sunshine in, two wires out, no maintenance in between. The theoretical maximum power from the pair is 20 watts, but since the panels are mounted at different angles they can never both see full sun at the same time (at least in THIS solar system).

This is hardly a problem, however, since the bike's loads are supported by a pair of six amp-hour lead-acid batteries, built around SAFT Gelyte packs. These replaced the original NiCd packs of my first 10,000 miles after experience demonstrated that despite a somewhat higher power-to-weight ratio, NiCds don't like the random charge-discharge cycles of a nomadic lifestyle.

Two photovoltaic modules and two batteries... this architecture is no accident. A pair of console switches allow the former to be swapped relative to the latter—or the latter to be swapped relative to the bike's loads. The first swap option allows a low battery to get the benefit of whichever panel happens to be receiving the most light; the second allows the computer battery to serve as a backup for the "lights and radios" battery during long night rides.

This raises an interesting issue: charge management. Ideally, this would all be controlled via A-D converters and power MOSFETs by one of the bike processors—something that was, in fact, one of my original specifications for the system software. But the catch here is that the computers are not necessarily powered up when battery charge levels are changing (keeping the bicycle-control processor on all the time would impose enough overhead to offset much of the system's efficiency). Still, a future enhancement will allow many of the charge management decisions to be made in software when the bike is online, now that the use of lead-acids allows battery level to be measured with some repeatability.

At the moment, I use two tools to keep the batteries healthy. The first is a simple brute-force circuit associated with each, consisting of a series-check diode to prevent dark discharge into the panels and a power zener that warms up when the battery's terminal voltage reaches end-state levels. This seems a bit crude these days, but the approach works noticeably better than my earlier active controllers that created noise and ate about 8 mA on standby.

The second charge-management tool involves what I have come to call my "wetware infosystem," otherwise known as the human brain. A front-panel Acculex digital panel meter displays the terminal voltage of each battery, as well as the algebraic sum of all charge and load currents. After 4.5 years on the road, I have developed an intuitive sense of battery health based upon casual ongoing observation of the displayed data.

As shown in Figure 1, this information is derived by observing the voltage drop across a 0.1 ohm resistor connected in series between each battery's negative terminal and system ground. (Doing it this way keeps op amp circuitry trivial.) This measured value, which linearly reflects battery activity, is scaled to +/− 5 volts by a micropower LM10. Then it is handed off to a thumbwheel switch that feeds any

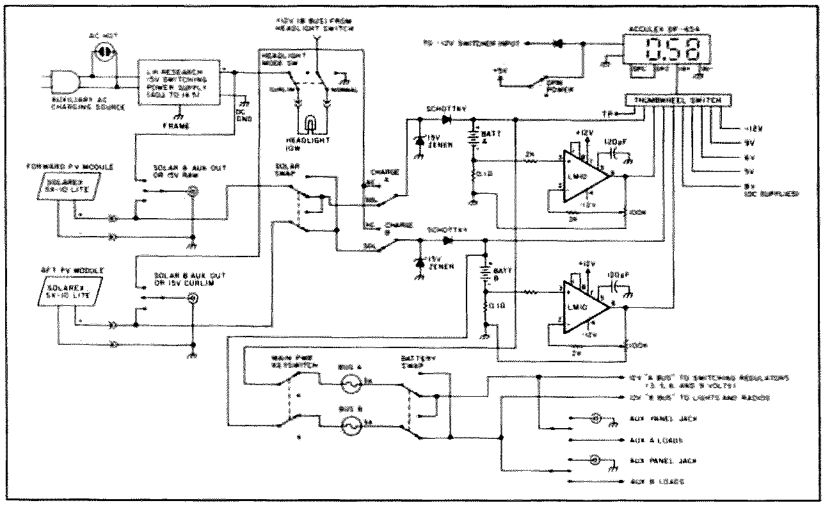


Figure 1. Winnebiko power management circuitry.

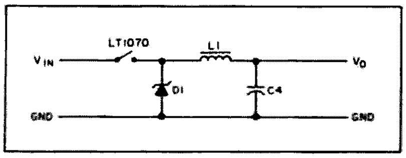


Figure 2. Positive buck converter.

of ten diagnostic voltages to the panel meter.

Let's take a quick tour of the rest of the overall circuit...

At the left of the diagram are three possible charge-current sources—the two photovoltaic modules and a 15-volt switching power supply that can let me refuel from the AC line if necessary. The latter needs a current limiter to avoid overstressing the batteries. Instead of adding a heavy resistor, I followed the old cyclist's maxim of making hardware do double duty: the headlight "mode" can be switched from normal to aseries charge-current limiter. (I'm so obsessed with light weight, you know...)

Continuing across the diagram, you can see these currents passing through the solar-swap and charge-source switches to make their way into the batteries via the diodes, yielding the voltage drop across the tenth-ohm resistors noted a moment ago. From that point, the battery power is available on two interchangeable buses, one of which feeds the array of switching supplies that provide subsidiary voltages for other bike electronics.

As this project progressed, I became increasingly concerned about efficiency. During the first 10,000 miles, I generated the lesser voltages with 3-terminal regulators—now-antiquated units that do their job by dissipating the product of load current and the difference between voltage-in and voltage-out. Such wastefulness I can no longer afford, so when the specs for power supplies began to take shape, I contacted Glenn Glassner of Precision Circuit Images in Columbus, Ohio. He knows about these things... so rather than fumble through the arcane theories of switching supply design, I now turn this article over to him for a glimpse of the radical changes that have recently come over the power-supply world. Glenn?

Miniature 5-Voltage, High-Efficiency Supply

Thank you. Steve's electronic bicycle requires 5 volts for extensive logic circuitry, and to support diagnostic equipment and future system enhancements, he specified 3-amp capacity. He also called for 3, 6, and 9 volts at one amp each, as well as a few hundred mils of -12 for op amps and RS-232 links. All of this had to live on a bicycle and be derived from a 12-volt battery, requiring that the circuitry be efficient, compact, and light weight. To make matters worse, time was at a premium, because Steve was leaving in two weeks... but then, Steve is always leaving.

One year earlier I would have said, "Impossible!" But now, thanks to Linear Technology Corporation, there is a new part on the market that does for switching power supplies, what the 3-terminal regulator did for traditional linear designs.

The finished five-voltage supply is housed in a 1.5 X 2.5 X 6.5- inch aluminum box, with all connections handled through ferrite filter pins to keep noise to a minimum. The supply is actually a collection of five separate switching regulators: four LT-1070CTs are used to provide the 3, 5, 6, and 9-volt outputs, and the -12 is derived from the +5 via an off-the-shelf DIP converter chip. Perhaps the most representative of all is the six-volt supply, and its schematic is shown in Figure 3. Before explaining the circuit, however, let me make a few comments about the LT-1070 chip itself...

LT-1070 Attributes

This device contains all the dynamic components required to build a current-mode switching power supply. For the novice, it is comforting to note that there only five pins to confuse. Other features include:

- 1.2 volt band gap reference
- 3—40 volt input range
- 40 kHz internal oscillator
- soft start
- current limit
- high peak switch current

The most important feature is the current limit, which can protect the device long enough for most people to breadboard and debug the circuit without smoking anything.

Now refer to Figure 2 for a bit of theory. The LT-1070 is a current-mode switching controller, shown in the diagram as a buck converter. The circuit controls the output voltage by varying the duty cycle of the switch: the longer the switch is on, the higher the V_O. D1 provides a return path for L1 current when the switch is off.

The most important thing about a switching regulator is that the switch is either on or off —there is no linear waste of power. The only notable items contributing to inefficiency in a well-designed switcher are the forward drop and resistance of D1, the resistance of L1, and the switch's ON resistance.

To control the duty cycle, the LT-1070 actually watches the inductor current ramp up—turning the switch off at the same current point in each cycle. Comparison of this trip point to the feedback from the error amplifier keeps the output voltage regulated. The spinoff of this is automatic limitation of the output current, making the device virtually indestructible.

The actual bike system circuit, (see Figure 3) was built directly from Linear Technology's application note #19 with my particular choice of available parts. Of the many possible circuit combinations suggested for the LT-1070, this use is perhaps the most confusing, since the device is floating on the output voltage. Because one side of the power switch inside the chip is connected to the ground pin, V_{SW} is shorted to ground when the power switch is turned on. To maintain the device supply, D3 and C3 thus store voltage while the switch is on.

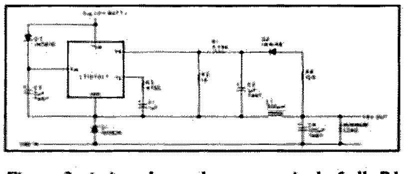


Figure 3. A six-volt supply, most typical of all. R1 and R2 are changed to adjust output voltages. 6V supply shown.

R1 and R2 take the reference output voltage and divide it to set the actual output voltage with respect to the band-gap reference. In this mode a minimum load of 100 mA is recommended for the 5-volt supply, and the others require some minimum as well. (Failing to do this results in overvoltage at the output.)

Output regulation of these supplies is actually much better than that of the batteries they replace, and I'm pleased to note there have so far, been no frantic calls for service from the road. Right, Steve?

Trouble-free

That's right, Glenn. The unit indeed came together within the two week deadline. For the last 5,000 miles it has been a trouble-free, low-overhead power source for a whole bikeload of CMOS logic, personal entertainment electronics, packet TNCs, and more. Each supply is switched on by an OR of steering diodes and front-panel toggle switches, keeping wasted power to a minimum at times of few loads. During normal bike activity, with only the 2-meter rig and the bicycle control processor on, each battery puts out about 100 mA... giving me roughly 25 hours of routine use on a full charge. (Night riding with all lights shortens this figure to 7 hours.)

And so, there it is: a self-maintaining, lightweight, efficient, solar-charged, multiple-output power supply. People often comment on the microprocessors, observing quite correctly that my high-tech nomadics never could have occurred a decade ago. But there are a host of other whiz-bang technologies as well; new devices that do not make the headlines very often, but still change the way we deal with the world. Buried in the bike, for example, is a 1-farad, 5.5-volt electrolytic capacitor about 1 inch tall. The switching supplies convert power at 85–90% efficiency. Distributed throughout the Winnebiko are the magical products of our collective technological consciousness, and I could never do it without them... even if they're NOT digital.

For information on acquiring lightweight, efficient solar panels from Solarex (about $145 in single quantities for the 10 watt units, contact ATG Solar at 800-826-3336 and mention this article.

To obtain two LM-1070 devices and Application Note #19, send $25.95 to Precision Circuit Images, PO Box 14026, Columbus OH 43214. Experimenters can also call 614-261-8043 for more information.

Cheers from Key West...

1987 World SSB Championship

160 Meter Contest Results

W/VE Single-Operator Category

Callsign	QTH	QSO's	States	Prov.	Country	Total Score
WB9HAD	IL	1,783	48	11	40	915,255**
KE5FI	TX	1,010	48	10	25	428,280*
W9UP	WI	919	48	10	5	289,800*
AD0O	CO	862	47	10	10	289,775*
W3GG (KA3PGL op)	MD	844	48	9	6	265,860*
VE3XN	ONT	748	48	10	11	261,510*
W4TMR	NC	788	46	9	10	255,775*
KS9O	IL	777	48	6	11	253,500*
WA1UJU	WI	850	47	7	3	242,280
K6HNZ	AZ	632	46	8	11	208,975*
N4LTA	SC	680	48	7	6	208,010*
KA1SR	RI	494	46	9	24	206,980*
WA0LRJ	WY	631	47	8	6	196,115*
K8XR	NJ	470	46	9	16	173,240*
K8HVT	CT	522	45	8	10	166,005*
K7IDX	WA	517	44	9	9	163,680*
KE7C (WB7OJV op.)	WA	510	47	8	7	162,442
W3TS	PA	483	47	9	7	153,720*
W0JLC	MO	374	48	8	19	146,625*
AA4MM	FL	357	47	7	24	143,520*
N4ICS	KY	495	46	7	2	133,650*
VE1BNN	NS	303	42	8	25	122,250*
KF4HK	NC	369	48	8	9	119,925
AG8W (K8MJZ op)	MI	455	43	7	2	118,300*
KI4UJ	KY	413	45	7	5	117,990
NE1I	NH	456	39	6	6	116,280*
NT0V	ND	350	47	6	8	108,275*
W9MQZ	WI	352	45	7	5	100,605
KE7BT	ID	346	47	7	3	99,465*
VE4WR	MAN	362	45	7	2	98,280*
N4HQT	TN	354	46	4	4	96,660*
W0EJ	IA	347	46	7	2	95,975*
W0HW	MN	268	46	7	14	93,130*
KG9D	IL	312	45	6	3	92,070
KV0I	NE	337	46	5	0	85,935*
N4FNB	TN	344	41	6	2	84,280
WD9INF	OH	321	46	5	0	81,855*
K8SVT	OH	291	44	7	3	78,570
N3II	MD	302	40	6	4	75,500*
VE2YU	QUE	230	45	7	10	73,470*
W9RE	IN	254	41	4	6	67,600*
NA2M	NY	282	39	6	2	66,270*
AA4LE	AL	263	40	6	4	65,750*
W1IS	MA	251	38	4	4	63,250*
KC7PA	UT	255	41	6	2	62,475*
K7RJ	UT	259	39	4	5	62,400
NI7T	OR	245	40	6	4	61,750*
N9DBV	IL	231	45	5	2	60,060
KA2VAZ	NJ	277	38	5	0	59,555
N5DUH	IA	266	44	2	4	56,750
K1TO	CT	216	44	6	2	56,420
KS7T	MT	233	39	8	4	51,510*
NA8W	OH	216	42	3	2	51,230
N7FMB	TX	195	41	4	5	49,000
VE2RO	QUE	201	35	7	3	45,900
KA0QQP	IA	192	42	5	0	45,120
ND1X	CT	220	32	4	4	44,800
K4GKV	GA	198	37	4	3	43,560*
N4ARO/6	CA	181	38	4	4	43,010*
NF7E	AZ	172	43	3	2	41,520
K8KEM	OH	174	41	4	1	40,020
KT4U	VA	133	37	6	8	39,270*
KI4DC	KY	192	36	3	1	38,400
NJ0X	MO	174	38	4	1	37,410
KI6MS	CA	153	40	3	4	37,200
N0FJP	MN	154	41	3	2	35,880
KC3LV	PA	143	42	5	1	34,560
KA9ACS	IL	148	38	4	2	32,560
W3CDG	MD	140	40	5	0	31,500
N4IKX	KY	154	35	3	2	31,200
WD8MCN	MI	157	37	2	0	30,615
W8VEN	WV	134	39	4	2	30,150*
N0AKC	WI	126	42	3	1	28,980
W4WKQ	FL	136	36	1	4	28,085
N9KS	WI	131	39	3	0	27,510
KD0EE	SD	120	41	4	0	27,500*
WB5SSD	LA	116	40	2	3	26,100*
W7MCU	WA	94	41	7	5	25,175
K4ADI	SC	117	30	4	0	23,400
W4UNP	SC	112	35	3	2	22,800
W1LUG	VA	117	33	3	1	21,665
W9HOT	IL	111	37	2	0	21,645
NU8K	WV	107	31	5	3	19,795
KC3OL	MD	100	33	3	1	18,500
W4HVU	NC	102	34	1	0	17,850
KA0PPW	WI	105	32	2	0	17,850
KI3L	NM	101	29	4	2	17,675*
N5AFV	TX	98	31	2	2	17,150
N8CXX	MI	101	28	3	1	16,320
W6PFE	CA	93	23	2	3	13,630
WB9SAV	WI	79	29	3	0	12,640
WA6FGV	CA	107	16	3	3	11,880
WA8GLF	OH	79	27	1	0	10,640
W7ABX	NV	74	22	3	2	9,990
K0JVZ	CO	65	28	2	0	9,750
N8AXA	OH	71	22	2	1	8,875
N7GLT	AZ	58	25	1	1	7,830
W4UYC	GA	61	24	1	0	7,625
W2CVW	NJ	53	22	3	0	6,625
KD7RX	WY	49	21	2	0	5,635
W0IH	MN	47	21	2	0	5,405
W8AKS	CA	43	20	1	0	4,515
N9EOM	IL	37	20	2	0	4,070
KC0ES	MO	38	19	1	0	3,700
N3RC	VA	34	18	0	0	3,060
K5ZD	MA	30	19	1	0	3,000
AK7F	WA	29	17	1	0	2,610
VE3IR	ONT	28	13	1	0	1,960
AA6EE	CA	25	10	1	1	1,620

W/VE Multi-Operator Category:

Callsign	QTH	QSO's	States	Prov.	Countries	Total Score
WB8IFP	OH	1,494	48	10	27	653,225**
KC1U	PA	1,256	48	9	25	529,720*
KC8P	MI	1,091	48	9	18	414,000*
WB8IGY	OH	1,066	46	8	11	348,400*
WA4JXI	FL	571	48	8	33	322,180*
NT5V	TX	801	48	9	14	287,550*
N0EKK	CO	588	48	8	7	186,165*
KB8AC	IN	366	47	5	6	106,720*
NE3F	PA	402	36	6	3	90,450
KA5DLM	LA	201	39	2	5	46,230*
WB6EGE	CA	175	33	5	3	36,285*
WV2ZOW	NJ	97	23	5	3	14,290

DX Single Operator Category:

Callsign	QTH	QSO's	States	Prov.	Countries	Total Score
XE1L	Mexico	286	44	4	16	119,040**
G4AVO	England	189	20	3	34	74,955*
CT1AOZ	Portugal	152	23	3	32	70,470*
CO2CB	Cuba	274	43	5	3	70,125*
G3NAS	England	184	18	4	35	69,825
HP1XXO	Panama	127	36	4	19	45,725*
YU2TW	Yugoslavia	102	14	4	30	35,280*
OK1KPU	Czechoslovakia	136	1	2	36	27,450*
KL7HBK	Alaska	28	13	1	2	2,320
I0KHP	Italy	29	0	0	12	1,800
I4CSP	Italy	21	2	0	11	1,560

DX Multi-Operator Category:

Callsign	QTH	QSO's	States	Prov.	Countries	Total Score
ZF2JA	Cayman Is.	210	41	6	21	75,140**

** World Champions   *State, Provincial, and Country Champions

40 Meter Contest Results

W/VE Single-Operator Category

Callsign	QTH	QSO's	St./Prov.	DX	Score
KE5CV	TX	1756	56	13	928,620**
KJ4CQ	NC	1196	56	18	446,960*
KS9O	IL	858	56	17	320,105*
NØCDH	MO	904	57	10	306,190*
N8CXX	MI	845	55	16	303,525*
K1KJT	MA	730	53	18	259,505*
WK4Y	VA	766	53	9	239,010*
ADØO	CO	709	51	13	229,120*
W4WKO	FL	665	52	11	217,665*
K5UCV	TX	591	50	13	189,000*
K9JS	IN	636	52	9	189,575*
WA2HFI	MN	669	51	5	187,320*
KVØI	NE	637	53	3	178,360*
K9OSH	WI	559	51	8	165,495*
NE9O	IN	507	51	8	149,975
W9NFW	IL	511	52	5	146,490
KA7DLV	MN	500	53	4	143,640
N9BKM	IL	461	55	6	143,045
WB5SSD	LA	451	54	7	140,910*
KC9GJ	IL	393	54	13	135,675
WA6FGV	CA	472	52	5	135,090
ND1X	CT	423	48	13	132,980*
WBØBJP	MN	419	52	9	124,490
AA4LE	AL	394	50	10	123,300
KZØC	IA	409	53	8	122,915*
KE7KF	UT	387	52	5	115,640*
KI3L	NM	345	47	6	92,220*
KDØHY	AR	362	46	4	90,500*
K4GKV	GA	307	48	7	84,425*
KF4GL	VA	367	43	2	82,575
KC7PA	UT	334	47	1	80,160
N3EMD	PA	313	48	0	75,120*
WA3DNC	KY	281	47	5	73,320*
KB6ATI	CA	299	44	4	72,720
KB4RME	VA	295	45	1	68,080
K4ADI	SC	289	41	3	64,240*
KI4UJ	KY	189	46	11	56,145
KC3OL	MD	214	42	9	55,080*
K8JM	MI	204	45	4	49,980
WS4N	GA	200	42	5	47,705
KA9BQA	IL	242	38	0	45,980
WC4E	FL	190	37	7	42,460
NR4S	TN	212	38	0	40,280
W6WBY	NV	147	41	8	37,240*
K5ZD	MA	150	40	4	33,000
KB4PNQ	FL	137	40	6	32,340
KD9OY	WI	117	41	3	25,740
KAØVYM	MO	135	36	1	25,160*
NØFMT	KS	109	41	4	24,975*
KJ4TI	NC	127	37	2	24,960*
N5IET	TX	110	39	5	24,640
YV6DLG	Venezuela	46	20	6	11,570
ON7WN	Belgium	51	0	21	5,670
OK1KZ	Czechoslovakia	5	0	5	175
WA5IYX	TX	102	40	4	22,660
KE7QA	UT	97	41	2	21,285
W4UYC	GA	106	37	3	21,285
K2PS	NJ	103	36	4	21,000*
WB9SAU	WI	97	35	9	20,900
KB4NAV	SC	109	38	0	20,710
KA2TWY	NY	118	34	0	20,060*
KAØPPW	WI	110	35	0	19,250
KA1NDY	RI	119	30	0	17,850*
NA8W	OH	103	32	1	17,160*
W4XT	KY	88	38	0	16,720
KF1B	CT	84	33	5	16,340
WK4F	FL	73	30	10	16,000
KD7RX	WY	91	33	0	15,015
KJ4YM	GA	84	33	2	14,700
K1TWF	MA	115	25	0	14,375
WB2TKD	NY	70	33	2	12,250
N7GLT	AZ	68	31	5	12,240
N5AFV	TX	67	34	2	12,060
KC3XD	PA	66	30	2	10,560
VE3HX	ONT	52	33	0	8,580
W9REC	IL	57	30	0	8,550
N8AXA	OH	49	24	0	5,880
N9EOM	IL	45	22	3	5,750
N6NKN	CA	47	23	1	5,640
KØJVZ	CO	46	22	0	4,950
KT2D	NJ	35	21	0	3,675
W1LUG	VA	37	19	0	3,515
KC3ZG	PA	25	19	1	2,500
KA3OGY	MD	29	16	0	2,320
N6NPZ	CA	22	11	0	1,210
KA7VMA	WY	17	12	0	1,020
K3TX	PA	17	11	0	935
KD7EO	NV	10	8	0	400

Multi-Operator:

Callsign	QTH	QSO's	St./Prov.	DX	Score
W2ZO	NJ	1177	55	21	460,940**
KB4RXM	TN	1152	57	6	362,250*
NT5D	TX	847	55	20	327,375*
KS3F	PA	851	54	19	316,455*
NK7U	OR	849	56	14	301,700*
WG5J	TX	805	53	12	263,575
W7MR	UT	655	54	6	198,000*
WA7YEJ	CO	572	52	5	164,160*
W4TMR	NC	411	49	17	141,240*
WA6HRH	CA	420	48	10	103,200*
KA5DLM	LA	221	44	8	58,500*
WV2ZOW	NJ	104	35	2	19,425

OX Single-Operator:

Callsign	QTH	QSO's	St./Prov.	DX	Score
KP4FI	Puerto Rico	1233	53	89	1,400,830**
8P9AF	Barbados	447	40	53	329,685*
ZS5K	S.Africa	326	37	25	184,450*
HC1OT	Equador	239	40	30	161,360*
XE1L	Mexico	337	50	25	160,500*
TI2DCR	Costa Rica	243	37	28	89,050*
HK3KRU	Colombia	108	27	9	34,920*
JH7WKQ	Japan	72	10	16	15,990
AH6EK	Hawaii	64	19	6	15,750

DX Multi-Operator:

Callsign	QTH	QSO's	St./Prov.	DX	Score
EI1DD	Ireland	350	3	44	86,245**
JA9YBA	Japan	11	6	2	840

Check logs: W7LQU, YY1C, EA5AEN, EA3CZM

** World Champions * State, Provincial, and Country Champions

160 Meter QSO Record

WB9HAD	1987	1783
WB8IFP	1986	1522
WB8IFP	1967	1494
WB9HAD	1988	1431
WØCEM	1986	1338
KM5X	1986	1313
KC1U	1967	1256
KC1U	1986	1210
N7DF	1985	1177
WØEJ	1985	1152

World 40 Meter QSO Records

Single Operator:

KE5CV	1987	1,756
N5AU	1986	1,397
KE5CV	1986	1,261
KP4FI	1987	1,233
KE5CV	1965	1,200
KJ4CQ	1967	1,196
K4XS	1985	1,196
KE5IV	1986	1,151
W1WEF	1984	1,042
KE5CV	1984	1,020

Multi Operator:

K3TUP	1985	1,381
K3TUP	1983	1,214
K3TUP	1964	1,196
W2ZQ	1967	1,177
KB4RXM	1967	1,152
N4DDS	1965	1,161
KYØS	1985	1,139
K8ND	1983	1,129
N9NB	1982	1,098
W2ZQ	1985	1,064

73 Review *by Bill Mick K3RVN/G0EZZ.*

ICOM America, Inc.
2380-116th Ave. NE
Bellevue WA 98004
Price Class: $1200

ICOM IC-R7000 Communications Receiver

The R7000 is an uncommon radio. It has an immense coverage range, nominally 25 to 1000 MHz, with a switchable preconverter that allows reception of 1025 to 2000 MHz as well. The basic design shows that Tuna was not far off in principle when he cascaded parts of his boat anchor collection. Of course, ICOM has done an elegant job of getting everything into one compact and clever box.

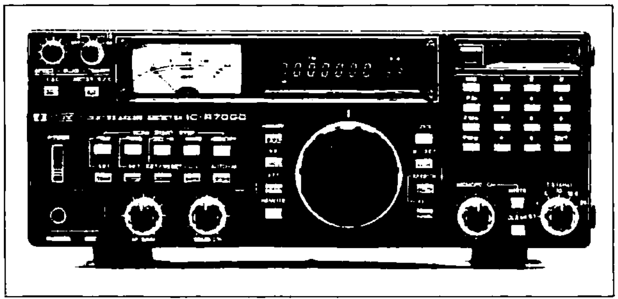
The front end is truly wideband in design, with four RF input amplifiers covering 25-90 MHz, 90-250 MHz, 250-512 MHz, and 512-1000 MHz. As the listener tunes upward through the ranges, a system of relays and switching diodes selects appropriate input bandpass filters, and the user may note a change in sound and background noise when passing from one level to another.

Below 512 MHz, the bandpass filters are varicap tuned, while stripline techniques are used from 512 to 1000 MHz. The wideband RF amplifiers are protected by tuned traps which suppress birdies from the first local oscillator. ICOM appears to have done a fairly good job shielding and partitioning the set's innards, and, with the antenna disconnected, there is little in the way of internally generated whistles. Of course, with a wideband receiver, fed by a wideband aerial in close proximity to a hamshack full of computers and micro-based radio gear, some peculiar intermod products are going to be heard sooner or later.

Occasionally, a nuisance signal could be removed by changing the channel on the shack TV set or shifting the HF receiver to another band. Getting the neighbor to change channels might not be so easy.

When tuning below 512 MHz, the R7000 uses a first IF of 778.7 MHz. In the upper half of the tuning range, the IF used is 266.7 MHz. From either of these IFs, it is a long dive to the 10.7 MHz second IF, but ICOM has installed notch filters to eliminate the images inevitable with such a conversion. A rear panel phono jack is provided for users who want to pick off the 10.7 MHz IF for use with the optional TV-R7000 television demodulator. This is also the place for a panadaptor, FM stereo adapter, or other gadget. Nine volts DC is available on the same jack, which is how the TV-R7000 is powered. The third IF is at 455 kHz, and is not used when wideband FM is selected.

Although the R7000 calls itself a communications receiver, that title is not quite accurate. It is certainly more than a garden-variety scanner, as it offers AM, NBFM, and SSB capabilities. However, hams may be disappointed that there are no narrow CW filters, not even as an option. Neither is there any selectivity adjustment by way of IF shift or passband tuning. The set has no RF gain control, although there is a 20-dB attenuator, handy when using a high gain preamplifier.


The ICOM IC-R7000. . . "everything into one compact and clever box."

I've used the R7000 as a super downconverter, hanging a general coverage HF receiver off the 10.7 MHz IF output.

R7000 Tuning

The R7000 PLL tunes in 100 Hz steps, and frequency selection can be performed via a large tuning knob, the front-panel keypad, or the optional RC-12 wireless controller. The set also has 99 memories, which can store frequency and mode. A small knob is used to select tuning step sizes for the main knob, from the basic 100 Hz, through 1 kHz, 5 kHz, 10 kHz, 12.5 kHz, or 25 kHz. The digital readout displays the frequency to 100 Hz. This step size is just adequate for readable SSB tuning, and hams who work SSB on VHF/UHF will probably find themselves wishing for 10 Hz steps. Serious VHFers usually want exactly the same features standard on HF radios, although I can't say I noticed the receiver's awkwardness in tuning SSB until I tested my Datong(UK) PC-100 HF upconverter with the R7000.

Which Antenna?

The R7000 is quite sensitive: a 3-by-1 signal on my FT-726R often becomes 5-by-1 when the antenna is switched to the R7000. The antenna, of course, ultimately determines the performance of this radio. A short whip stuck in the rear panel N connector captures FM broadcasts, strong 2 meter stations, and maybe some public service transmissions. When I tried a foot-high military surplus discone made of steel measuring tape, fed with RG-58, quite a bit more could be heard.

The R7000 came into its own when I put a 25-1300 MHz discone up on the roof and connected it with Belden 9913. This antenna was purchased in the United Kingdom for the equivalent of $60 and resembles the ICOM AH7000. Heath also sells a copy of this antenna at a competitive price. For a unity-gain omni that receives and transmits in a lot of VHF/UHF ham bands, the discone is hard to beat.

Uncanny Scanning Action

With so much spectrum to listen to, a guidebook is a must. Check with the local ham dealer, and check the ads in *73* or the *Monitoring Times*. I garnered most of my R7000 experience while living in England, where I found a ranges of interest, the R7000's six scanning modes help catch whatever's there. The user can hop between the current frequency and the local calling channel in the ham bands, using the Priority Scan. Enter Low and High frequencies bounding a Programmed Scan range, and the radio faithfully cycles stepwise through all the frequencies in between.

It's possible to perform a full Memory Scan of the 99 memories, or mark certain ones to include in a Selected Memory Scan. It is possible to restrict the memory scan to memories set with a particular mode. For people who appreciate labor-saving devices, the Auto-Write Memory Scan can search a specified range, storing the frequencies of found signals in memories 80 through 99. The R7000 can't identify signal types, so the user does have to preset the expected mode.

The operator can even vary the scanning rate! At the slowest rate, 36 unoccupied channels can be covered in about 15 seconds, while the fastest scan covers the same range in about 4 seconds.

Scan function can also be tailored with a delay control that sets the dwell time on frequencies where energy is detected. The

user can direct the set to park on a busy frequency until the activity drops, at which time the scan continues. One can also set the dwell for either five or fifteen seconds before scan resumption. There is also a setting to have scan auto-cancel on the first busy frequency.

Voice Scanning Circuit

Frequencies that break the squelch and halt the scan sometimes don't have anything intelligible to listen to. The R7000 provides a Voice Scanning Circuit which is supposed to skip dead carriers. Since this circuit is only a 1 kHz low-pass filter and detector gated with the squelch, it's easily fooled by non-voice signals, of which there are many. The VSC does work after a fashion, and provides some relief for the eardrums.

ICOM equipped the R7000 with its new CI-V serial computer interface. The connector is an ordinary phono jack at the TTL level, and the user's manual shows a simple schematic for breaking this line out via 1488 and 1489 TTL to RS-232 chips so that one can hook the radio to a computer's serial port. There is no detailed documentation on the programming of this interface in either the user's manual or the service manual, but ICOM USA readily provides supplementary data to its customers. A shack that has several late-model ICOM radios will find the CT-17 interface box the easiest way to connect them to a single RS-232 port.

Signal Recording

Those who love the idea of a radio that performs an unattended signal search will love the R7000's recording facility. The set has an independent, constant level output and a squelch output jack which can key the recorder's pause line. If the EX-310 voice synthesizer option is installed, a rear panel switch enables the dictation of the current frequency to the tape recorder along with the captured signal. I don't have the EX-310, so I don't know how well this feature works. The squelch output line can also be used to control an external alarm, perhaps to alert the operator of the presence of a beacon.

R7000 Rear Panel

Among the various rear-panel paraphernalia is a switch that selects upper or lower sideband (the front panel switch simply enables whichever sideband has been selected). Another switch sets the FM wide versus FM narrow bandwidths. In one position, narrow is 6 kHz, with wide at 15 kHz, while the other position puts narrow at 15 kHz and wide at 150 kHz. I find narrower settings more useful for my amateur work. It is also possible to set the AM filter width to 6 or to 15 kHz by means of an internal jumper.

Nit-Picks

In a radio with so many good features, there are bound to be a few negatives. I was disappointed to find that I could only set the high and low bounds of the programmed scan range via the keypad. There is no way to write these special memories using the tuning knob or from the 99 main memories. I really wanted to store useful frequency pairs in the memories, but there is no recall button to bring the values from the numbered memories to the High-Low or Priority registers. On the plus side, the R7000 lets you tune around a selected memory with the main knob, without disturbing the memory, much like the IC-751A.

Twenty-three centimeter fans in particular should bear in mind that the memories cover only 25–1000 MHz. The user needs to engage that sneaky little 1 GHz switch manually, since the memories don't know whether the down-converter is in the path. In setting up scans, I thought of numerous capabilities I would have liked, such as chaining together several separate scan ranges, but this is probably too much to expect in the basic receiver. It should be possible with the computer port to set up any oddball scanning routine, letting the external computer facilitate the programming through files of memorized frequencies.

The placement of the recorder output jack on the front panel isn't all that handy, especially since the recorder pause control jack is on the back, and I really wish that ICOM had put the USB/LSB selector on the front panel instead. I also think that push-button selection of tuning step size would be slightly easier than the rotary control in the current design. A 10-Hz minimum step would have been preferable to the 100 Hz step, or a clarifier control might have been added for SSB.

One surprising omission from a so-called communications receiver is a muting jack that can be tied to a station's PTT circuit to prevent feedback on transmit. Fortunately, the rear panel has a lot of empty space for additional connectors, since the one spare phono jack provided by ICOM won't be enough for the experimenter. ICOM also sells a 12-volt DC connector option.

Despite the relatively minor shortcomings of the set, which I am sure ICOM will fix when they get around to marketing an R7000A, I love this radio. Mine is on every day, checking beacons, watching the calling channels, complementing my other VHF and UHF gear. It is sensitive, stable, and flexible, and the manual is very helpful. I regret not buying the RC-12 wireless controller, since the scan often catches a snippet of conversation that piques my interest while I'm seated across the room.

The price is high, but the R7000 is still a bargain compared to the professional surveillance receivers one usually associates with this level of coverage. When I purchased mine, the dealer told me it was the fifty-first he had sold that month. Uncle Sam bought the other fifty. ■

Bill Mick has been licensed for 25 years. His main interests include electronic construction projects and fine French food and wine. Address comments and questions to him at PO Box 565, APO New York NY 09210.

Armed Forces Day 1988

Communications Test

contributed by Arthur R. Delperdang Chief, Navy-Marine Corps MARS

The annual Armed Forces Day Communications Test is set for Saturday 21 May 1988. This marks the 39th anniversary of this event, which emphasizes a continuing climate of mutual assistance and warm esteem between the military and amateur radio communities. The traditional military-to-amateur cross band operation and broadcast of the Secretary of Defense message are the featured highlights which include operations in CW, SSB, RTTY, and Packet radio.

These tests give both amateur radio operators and short wave listeners (SWLs) the opportunity to demonstrate their individual technical skills. Special commemorative acknowledgment QSL cards will be awarded to those amateur radio operators achieving a verified two-way radio contact with any of the participating military radio stations. Interception of these contacts by SWLs are not acknowledged by QSL cards, however, anyone who receives and accurately copies the Armed Forces Day CW and/or RTTY message from the Secretary of Defense can qualify to receive a special commemorative certificate from the Secretary.

Cross Band Contacts

The military-to-amateur cross band operations will be conducted from 21/1300 UTC (Universal Time) to 22/0245 UTC May 1988.

The military stations participating in cross band operations are:

AAE
HF/MARS Radio Facility
Fort Sam Houston TX

AAG
Army HF/MARS Radio Facility
Presidio of San Francisco CA

AIR
2045th Communications Group
Andrews Air Force Base
Washington DC

NAM
Naval Communications Area
Master Station LANT
Norfolk VA

NAV
HQ Navy-Marine Corps
MARS Radio Station
Cheltenham MD

NPG
Naval Communication Station
Stockton CA

NPL
Naval Communication Station
San Diego CA

NMH
Coast Guard Radio Station
Alexandria VA

NMN
Coast Guard Communications Station
Portsmouth VA

NZJ
Marine Corps Air Station
El Toro CA

WAR
HQ Army MARS Radio Station
Fort Meade MD

Military stations will transmit on the frequencies listed below, and announce the specific amateur band frequency being monitored.

Freq(kHz)	Emission	Station
4001.5	LSB	NPG
4010	CW	NPG
4015	CW	NMH
4018.5	LSB	WAR
4025	LSB	AIR
4028.5	LSB	AAE
4033.5	LSB	AAG
6970	CW	NPG
6988	RTTY/CW	AAG
6995.5	CW	AIR
6997.5	CW	WAR
7301.5	LSB	NPG
7315	LSB	AIR
7346.5	LSB	NMH
7358.5	LSB	AAE
7365	CW	NPG
7372.5	RTTY	NAV
7375	RTTY	NZJ
7382.5	RTTY	NPL
7393	USB/RTTY/CW	NMN
10259.5	CW	NPG
13927.5	RTTY	NPG
13975.5	CW	NPG
13986.5	RTTY	AIR
13992.5	RTTY/CW	WAR
13994.5	USB	AAE
13997.5	CW	AIR
14375	USB	NPG
14385	USB	NPL
14389.5	USB	NAV
14400	USB/RTTY/CW	NAM
14403.5	USB	WAR
14408	USB	AIR
14440	RTTY	NMH
14480	USB	NZJ
14488.5	USB	AAG
14665	RTTY/CW	AAE
20937.5	USB	NMH
20992.5	PACKET	AAE
20994.5	USB	WAR
20998.5	CW	NPG
2146.0	USB	NPG
27992.5	USB	AAE

Receiving Test

The CW and the RTTY broadcast will be special Armed Forces Day messages from the Secretary of Defense to any amateur radio operator or SWL desiring to participate. A ten-minute tuning call will precede each transmission. The CW braodcast will be transmitted at 25 wpm beginning at 22/0300 UTC May 1988. The RTTY broadcast will begin at 22/0345 UTC May 1988 and transmitted 60 wpm using 170 Hz shift. Both the CW and RTTY broadcast will be transmitted from the following stations on the listed frequencies:

Transmitting Station	Frequency (kHz)
AAE	4018.5, 6988, 9990
AAG	4021.5, 7309.5, 13994.5
AIR	6995.5, 13997.5
NAM	4005, 7393, 14400
NAV	7372.5, 14389.5
NPG	4010, 7365, 13975.5
WAR	4028.5, 6997.5, 14403.5

Submission of Test Entries

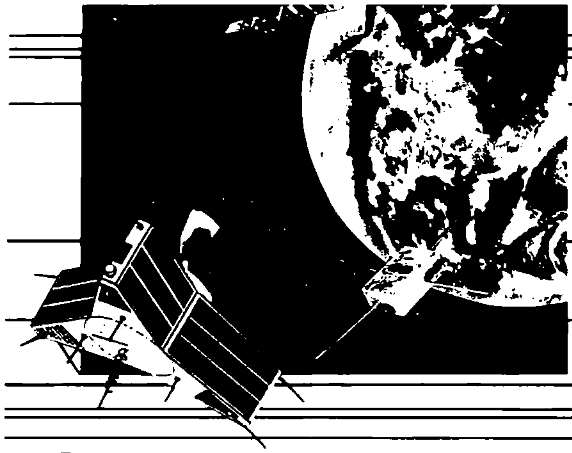
Transcriptions of the CW and/or RTTY receiving tests should be submitted "as received." No attempt should be made to correct possible transmission errors. The time, frequency, and callsign of the military station copied, as well as the name, callsign, and address of the individual submitting the entry, must be indicated on the page containing the test message. Entries must be postmarked no later than 28 May 1988 and submitted to the respective military commands as follows:

Station Copied and Address

AIR
Armed Forces Day Test
2045CG/DOJM
Andrews AFB
Washington DC 20331-6345

AAE, AAG, WAR
Armed Forces Day Test
Commander, USAISC
ATTN: AS-OPS-OA
Fort Huachuca AZ 85613-5000

NAM, NAV, NPG
Armed Forces Day Test
Naval Communication Unit
Washington DC 20397-5161



FAX Program for the AEA PK232

Make the most of your PC's graphics

by Roger M. Johnson WB0GAI

Almost everyone who has had a chance to get their fingers on the new AEA PK-232 agrees that it is an amazing piece of gear. It offers many options previously requiring many separate components. I enthusiastically tried all options and worked all the modes it allows.

I ordered the upgrade kit as soon as the FAX mode was announced and within a few weeks had it up and running weather facsimile from many HF FAX stations around the country. I soon learned, however, that this used reams of paper—an afternoon's run might use over ten feet! This is also terrific wear-and-tear on the printer and ribbon.

Since I had just acquired an IBM clone and graphics display, I decided to find a way to route printer output to the screen. The result is a basic program called SCREENFAX which runs on an IBM (or clone) with either a color graphics adapter (CGA) or extended graphics adapter (EGA). Since it's written using Microsoft QuickBasic II (or III), it isn't line-number dependent. (QB is a compiled basic and, because this program needs all of the speed the computer can muster, it probably won't work very well going through an interpreter.)

How It Works

AEA wrote the FAX program with the EPSON graphics standard in mind. According to this standard, the printer prepares to receive a control command when it receives escape code CHR$(27). The next several characters command it to do a number of different things, such as enter compressed mode, double-strike, or graphics. AEA programmed the PK-232 to send the printer commands which initialize the graphics mode and set the line spacing. The PK-232 then sends characters one after another which the printer now interprets as commands to the individual pins in the printhead rather than ordinary ASCII characters.

SCREENFAX takes this same information, modifies it for the IBM graphic displays and puts it on the screen rather than the printer.

Printer Commands

Let's look at this in more detail. On the EPSON printer, there are eight vertically-placed pins that can be commanded (in graphics mode) to fire individually. If the printer receives CHR$(1), only the bottom pin fires. CHR$(2) fires the next pin up only, and CHR$(3) will fire both. Any value from zero to 255 can be sent, and its binary representation will go to the printhead. After the initialization commands are sent, the printer looks at each character, interprets it as a binary number and fires the appropriate pin combination. It then looks at the next incoming character and repeats the process.

Depending on the printer's capability, the user can tell the PK-232 to send it a prescribed number of characters before starting the next line. For example, I can send my EPSON MX-80 a graphics command (GR 1), and it will send the printer 960 dots per line or 120 dots per inch. The user can command the PK-232 with the Graphics command to send anything from 60 dots per inch (GR 0) to 240 dots per inch (GR 3) depending on the printer's capabilites. AEA may well have been thinking about the IBM graphics display when they added GR 4—this allows for 640 bits across a screen, which is the horizontal pixel length for some of the screen commands in both the EGA and CGA displays. What appears on the printer copy is the map or picture printing as wide as the GR command specifies, and eight dots high at a time. (Remember the printhead has eight vertical pins). Figure 1 shows how all this happens.

> ***"SCREENFAX simply convinces the computer that it is a printer."***

Character number one has a value of 27 and tells the printer to get ready for the rest of the control codes. Character two tells it to get ready for 960 dots across the page. Characters 3 and 4 determine the actual line length (960 dots in this case). The printer sees characters 5 through 960 as graphics characters and fires the pins in response to the binary value of the character. When the printer again sees the first four codes, it moves down eight dots and starts over. This continues until the user tells the PK-232 to do otherwise.

Enter SCREENFAX

This is all fine for those who don't mind using a lot of paper. For casual viewing, however, SCREENFAX is fine for getting a good idea of what is printing. SCREENFAX simply convinces the computer that it is a printer so it can respond to the commands from the PK-232 and print the map or picture on the screen instead of the printer. Those with an EGA card and monitor will have excellent detail, but detail with the CGA card and monitor is still very good.

The Program

SCREENFAX begins with an initialization routine to set up the appropriate screens. These are both listed as REM statements. Pick the appropriate one by eliminating the word REM. This also sets the X and Y values to zero. Next, SCREENFAX asks for the filename. Any name that DOS accepts is fine. It then asks if the user wishes to start an input display from the PK-232 (and start a file with the given name) or to "play back" a previously saved file. One choice opens the communication port, the other opens the previously saved disk file.

The next few paragraphs discuss the program routines.

OPCOM

This routine opens the communications port first by clearing things out with a CONTROL C, and then setting up the port for input from the PK-232. It then puts the PK-232 into TRANSPARENT mode, as suggested by AEA. A file with the designated name is opened for output to the disk drive. The variable "V" is set to a value of 1 so that the main portion of the program knows whether or not to save the material to this file. The screen is then cleared and, if the PK-232 is synchronized to the incoming map or picture, a line 8 pixels high appears, starting at the upper left of the screen and moving across it horizontally. Sometimes the user catches the PK-232 part way through a line and gets a partial line at the top, but it synchronizes with the next line. The map appears eight lines at a time.

OPDISC

The routine opens a previously saved file of the designated name and begins displaying it on the screen. It will appear exactly as received.

BEGIN

This is where most of the hard work in the program occurs. BEGIN begins by looking

for an input character, either from the disk or the communications port. Since CHR$(26) may be seen as an end of file marker, I added a line that changes anything with that value to a value of 24. This keeps the file from being stopped prematurely.

The program then looks for a CHR$(27). Recall that this is what tells the printer that a command (instead of another routine character) comes next. When the program finds CHR$(27), it skips to the ESCAPE subroutine.

ESCAPE

This immediately begins looking for the next character. The routine turns the character into a number with the ASC function and, after getting rid of any character with a value of 26, it looks to see if it has a value of 42. This number has special importance for setting up the screen and locating the cursor. If ESCAPE sees a CHR$(42) it prints subsequent characters on the screen as graphics characters. A glance at the graphics commands in the addendum to the PK-232 manual shows that the PK-232 code "42" is an asterisk which can be used to tell the program that a new line is starting. The X axis is set to zero and the Y axis is advanced by eight pixels. Note that ESCAPE hangs onto this character and, if it doesn't happen to be a 42, it can return with it to the main program. The PK-232 normally sends the escape code as an ordinary character. Only when it is followed by a 42 does the program see it as a command code. In all other cases it's treated as an ordinary character. When ESCAPE has done its thing, it drops into FINI, a one-line routine that routes the flow to the appropriate place in the BEGIN routine called RTRN.

RTRN

This is where the graphics work goes on. It looks at the ASCII value of each incoming character and ANDs each bit to determine its state ("1" or "0"). One turns the color value to a zero or dark (dark blue in EGA, black in CGA). Zero turns the color to white. The program compares each bit and, with the PSET command, sets the appropriate pixel to the chosen color.

After a character finishes, the X and Y values do the appropriate housekeeping. If Y is greater than 350 in EGA mode, or 200 in CGA mode, the routine sets the display back up to the upper left hand corner and the remainder of the map overwrites the earlier portion of the map. The routine recycles through BEGIN after each character is displayed.

There may be some elegant fashion to stop program execution, but hitting CTRL-BREAK works fine.

Pointers and Bugs

This program has a few quirks. It will sometimes crash when the PK-232 is sending out a stream of characters. This rarely occurs, however, and has an easy remedy—just restart the program.

The program tends to lag behind running on a 4.77-MHz clock speed PC. This is not so bad, because most of the weather services pause between pictures, which gives the program time to catch up. There's a tendency in turbo mode for the system to lock up, but I haven't yet determined if it's a hardware or software problem.

When compiling this program in QuickBASIC, use the following syntax to enter BASIC:

QB /c:32000

This creates a buffer that is 32000 characters long. This allows the program a lot of lag-time before sending a "communication buffer overflow" error message. Those using a PC in turbo mode can get by with a smaller buffer, since it's fast enough to stay well ahead of the PK-232 output. Users can also create an executable free-standing program by using the Separate Compilation Method described in the Microsoft manual.

The PK-232 needs initialization before running SCREENFAX. Use the following commands for the PK-232:

cmd:TRFLOW OFF
cmd:TXFLOW OFF
cmd:AWLEN 8
cmd:FAX
cmd:ASPECT 2
cmd:FSPEED 2
cmd:LEFTRITE ON
cmd:GRAPHICS 4
cmd:LOCK
(This command forces a display. Otherwise, there's no display until the PK-232 synchronizes with the incoming signal.)
cmd:PRCON OFF
cmd:PRFAX OFF
cmd:PROUT OFF
cmd:PRTYPE 2

The ASPECT, FAXNEG, FSPEED, and LEFTRITE commands are not critical to the display. No image at all appears without setting GRAPHICS to 4 and PRFAX to OFF.

```
        REM NAME OF THIS PROGRAM IS SCREENFAX
        REM BY ROGER M. JOHNSON
        REM DESIGNED TO TAKE DATA FROM THE PK232 FAX INTERFACE, SAVE IT INTO A
        REM FILE AND DISPLAY IT ON THE SCREEN OF AN IBM PC OR PC CLONE WITH
        REM CGA OR EGA.


        REM PSET INITIALIZE
        REM USE THE FOLLOWING 2 LINES FOR A SYSTEM WITH EGA. REMOVE THE REM
        REM SCREEN 9,1
        REM COLOR 14,1
        REM USE THE FOLLOWING LINE FOR A SYSTEM WITH CGA. REMOVE THE REM
        REM SCREEN 2
        X=0
        Y=Y+8
        REM SCREEN CLEAR
        CLS

        REM FILE OPEN ROUTINE
        LOCATE 3,35
        PRINT "SCREENFAX"
        LOCATE 5,25
        PRINT"BY ROGER M. JOHNSON, W0OGA1 10/87"
        LOCATE 9,20
        INPUT "PLEASE LIST THE FILENAME YOU WISH TO USE ";F$
        LOCATE 11,33
        PRINT "DO YOU WISH TO:"
        LOCATE 13,28
        PRINT "(1) DISPLAY INPUT FROM PK232"
        LOCATE 15,28
        PRINT "(2) DISPLAY PREVIOUSLY SAVED FILE "
INKEO:  I$=INKEY$
        IF I$="1" THEN GOTO OPCOM
        IF I$="2" THEN GOTO OPDISC

        GOTO INKEO
OPCOM:  OPEN "COM1:1200,N,8,1,CS0,DS0,CD0" FOR OUTPUT AS #1
        PRINT #1,CHR$(3)
        PRINT #1,"TRANS"
        CLOSE #1
        OPEN "COM1:1200,N,8,1,CS0,DS0,CD0" FOR INPUT AS #1
        OPEN F$ FOR OUTPUT AS #2
        V=1
        CLS
        GOTO BEGIN
OPDISC: OPEN F$ FOR INPUT AS #1
        V=0
        CLS
        GOTO BEGIN
        REM MAIN ROUTINE
BEGIN:
        C$=INPUT$(1,#1)
        IF C$=CHR$(26) THEN C$=CHR$(24)
        IF V=1 THEN PRINT #2, C$;

        REM EVALUATION AND DISPLAY OF EACH BYTE
        REM N IS THE NUMERIC VALUE OF THE BYTE
        N=ASC(C$)

        IF N=27 THEN GOTO ESCAPE

RTRN:
        D= N AND 1
        IF D=1 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 2
        IF D=2 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 4
        IF D=4 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 8
        IF D=8 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 16
        IF D=16 THEN C=0 ELSE C=15
        PSET (X,Y),C
        Y=Y-1

        D= N AND 32
        IF D=32 THEN C=0 ELSE C=15
        PSET  (X,Y),C
        Y=Y-1

        D= N AND 64
        IF D=64 THEN C=0 ELSE C=15
        PSET  (X,Y),C
        Y=Y-1

        D= N AND 128
        IF D=128 THEN C=0 ELSE C=15
        PSET  (X,Y),C

        X=X+1 : Y=Y+7 : N=0 : D=0
        REM USE THE FOLLOWING LINE FOR A SYSTEM WITH AN EGA. REMOVE THE REM.
        REM IF Y>350 THEN Y=0
        REM USE THE FOLLOWING LINE FOR A SYSTEM WITH A CGA. REMOVE THE REM.
        REM IF Y>200 THEN Y=0
        GOTO BEGIN

ESCAPE:
        C$=INPUT$(1,#1)
        IF C$=CHR$(26) THEN C$=CHR$(24)
        IF V=1 THEN PRINT #2, C$;
        N=ASC(C$)
        IF N=65 THEN X=0
        IF N=65 THEN Y=0
        IF N=65 THEN CLS
        IF N=65 THEN GOTO FINI
        IF N=42 THEN X=0
        IF N=42 THEN Y=Y+8

FINI:   GOTO RTRN
```

Figure 2. PK-232 FAX program for the IBM PC.

Those without QuickBASIC or the desire to type the code into their machine can buy from me the disk containing the .EXE program, source code, and a sample file, for $10 postpaid. Please send requests to 1627 36th Ave. Ct., Greeley CO 80634. I would also appreciate any comments and ideas on this program.

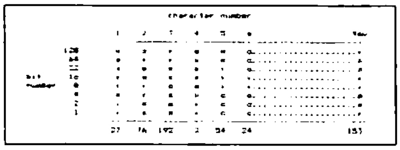


Figure 1. Graph showing the binary control commands sent to the printer to initialize a line of facsimile output.

73 Book Review

Definitive DXing and Practical Antennas

The Experts Speak Out

reviewed by Arliss Thompson W7XU

Low-Band DXing
by John Devoldere ON4UN
Published by American Radio Relay League, 1987
Newington, CT
Softbound, 266 pages (illustrated)

Imagine working nearly all ARRL DXCC countries on 80 meters. Or contacting stations in 140 countries on 160 meters in just a few months. Few hams can list those among their ham radio accomplishments, but one who can is John Devoldere ON4UN. Mr. Devoldere can now add to his list of accomplishments *Low-Band DXing*, which is a compilation of the author's considerable experience on 40, 80, and 160 meters, serves as an excellent source of information for those who are interested in operating on those bands.

This 266 page book has eight chapters covering topics like propagation, equipment, operating techniques, and a literature review containing over 500 references listed by subject. In the first chapter the author covers some propagation basics, then goes into more detail regarding grey line and non-great-circle paths. Three relatively short chapters are devoted to transmitters, receivers, and transceivers, and Mr. Devoldere also provides some hints on low-band DX operating techniques elsewhere in the book.

The bulk of *Low-Band DXing*, however, is devoted to antennas. Over the space of 133 pages the author covers theoretical and practical aspects of long and short dipoles, tall and short verticals, inverted vees, sloping dipoles, vertical dipoles, loops, arrays, feed lines, and special receiving antennas. The antenna chapter includes over 170 figures and 47 tables that, in conjunction with the text, provide a wealth of information. The reader lacking a technical background may have some difficulty with the theoretical discussions in the text, but he should still find the practical hints provided by the author to be of considerable interest. While obviously geared toward the low-band operator, this section should prove fascinating reading to anyone interested in antennas in general.

Chapter 7 of the book consists of the listings for twenty-four computer programs of interest to the low-band DXer and antenna experimenter. Written in Applesoft™ Basic, it includes, among others, a design program for lumped-constant loaded-vertical antennas, L-network design, influence of element taper on resonant frequency, and radiation pattern calculation for vertical arrays. The programs, plus some others not listed in the text, are also separately available on disk from ARRL for use on many popular personal computers.

In short, *Low-Band DXing* is an excellent resource that should prove very useful not only to low-band DXers, but also to antenna enthusiasts at large. Considering what it contains, it's a steal at $10. This book is must reading for those interested in working DX on amateur MF and lower HF bands. Mr. Devoldere and the ARRL have a winner here.

W1FB's Antenna Notebook
Doug DeMaw, W1FB, author
Published by the ARRL, Newington, CT
124 pages, softback, illustrated, $8

If there is one subject that nearly all amateurs have an interest in, it is antennas. Unfortunately, if an amateur lacks a strong technical background, there aren't many good books available that describe how to build and adjust simple antennas. *The ARRL Antenna Book* is an excellent reference, but a few hams are frightened away by the mathematics, Smith charts, and theoretical discussions contained in that text. If the amateur is interested in the practical aspects of antennas, but thoughts of differential equations and building a stressed 20 foot parabolic dish leave the amateur cold, he is apt to find Doug DeMaw's latest book, *W1FB's Antenna Notebook*, to his liking.

As stated in the book's foreword, Mr. DeMaw wrote the text with the amateur, not the engineer, in mind. Using a plain-language approach, he covers a wide range of topics that will be of interest to the practical-minded ham. It is nearly impossible to discuss antennas without introducing some mathematics, but DeMaw keeps it to a minimum, only invoking simple equations when necessary to calculate antenna or feedline lengths. Likewise, the text is devoted to basic antenna types, mostly constructed from wire. When he describes "obscure antennas," he is referring to limited space and "invisible" antennas, not to Sterba arrays. Along with the text are numerous diagrams to aid in the understanding of the antennas and ideas presented.

The book is composed of nine chapters, beginning with a discussion of some fundamental antenna data. Subjects covered in that section include, among others, coaxial cable considerations, balun transformers and correct balun use, the effects of insulation on antenna wire, and "the nitty gritty of SWR."

The next three chapters are devoted to building and using simple dipole, end fed, and vertical antennas. DeMaw first provides hints on how to construct single and multiband dipoles, including the G5RV and trap dipoles. He also covers the basic in's and out's of end fed wires, then goes on to discuss how to build verticals when lack of space forces the amateur to go up, rather than out with his antennas. The vertical antenna discussion includes information on how to excite the amateur's tower, building low cost ground plane verticals, and top-loading short verticals.

The reader with lots of room to erect antennas is apt to find the chapter on high-performance wire antennas of particular interest. Large loop antennas are described, including information on their directivity and how to feed them, plus a short section on collinear arrays. The chapter closes with a description of "cloud warmers"–antennas purposely designed to emit the high angle radiation necessary for short-range communications on the MF and lower HF bands.

Limited-space antennas, including indoor types, are detailed in Chapter 6. The three subsequent chapters discuss matching techniques, special receiving antennas, and simple antenna measurements (using a field-strength meter, building a practical SWR bridge, etc.).

In summary, it's an easy to read book that covers the basics on the wire antennas that many amateurs use daily. If the amateur is looking for design information on 36-element quagis for 1296 MHz, he has come to the wrong place. On the other hand, if he is looking for the straight scoop on baluns and how to use them, *W1FB's Antenna Notebook* may be just what the doctor ordered. ■

Number 19 on your Feedback card

Schedule for the Dayton Hamvention 1988

April 29 thru May 1

Friday, April 29

Packet Radio, Session 1 with Bob Neben K9BL, Moderator
Antennas Tim Duffy K3LR, Moderator
Writers Conference W. Clem Small KRGA, Moderator
Packet Radio, Session 2 with Bob Neben K9BL, Moderator

Friday Activities

1200–1800 Exhibits open, prizes on display. Flea Market open. Registration and program books available at all ticket selling points
1300–1700 Forums and scheduled activities.
Please Note: Exhibit area closes promptly at 1800.
19th Annual B*A*S*H* Friday evening at 6:30 at Hara Arena Center. Free admission. Hot dinner, sandwiches, desserts, and beverages avail. Continuous family entertainment beginning at 7:00 and many prizes. The "Conference Center" entrance will be open after the exhibits close.
DX Dinner (Third Annual) Sponsored by Southwest Ohio DX Association at Stouffer's Dayton Plaza Hotel (across from the Dayton Convention Center). Program will be "S0RASD operation by Marti Laine OH2BH." The M.C. will again be Jay Slough K4ZLE. Displays and cash bar at 6:30, dinner at 7:00. Advance reservations are required. Send check for $20 each to Jay Slough, 8183 Woodward Dr., West Chester OH 45069. Many DX hospitality suites will be open at Stouffer's on Friday and Saturday evenings. Plan to visit them after enjoying the DX Dinner.
Far-Out A.R.C. Hospitality Blitz 8 PM to midnight at the K. of C. Party Room, 267 Bainbridge St. (just 3 blocks east of Stouffer's Hotel). Free snacks and beverages. Listen 147.135 (plus offset). See 1987 or 1988 program for map.

Saturday, April 30

Antenna Tuners Ken Glanzer K7GCO, Moderator
VHF/UHF Forum Joe Burke WA8OGS, Moderator
Kent Britian WA5VJB, Speaker
Terry Price WD8ISK, Speaker
Dr. Rich Dorsch NE8Z/HC1MD, Speaker
Combined MARS Forum Art Delperdang K4KBI, Moderator and Keynote Speaker
ARES Larry Solak WD8MPV, Moderator
Geritol Net Forum Bert W. Sullivan W8EHX, Moderator
Eugene R. Mayler K8EE, Net Official
Jimmy D. Hardee KT5F, Net Official
OSSBN Harold C. Chapman WB8JGW, Moderator
ARRL Technical Talk Al Markwardt W5PXH, ARRL, Moderator and Speaker
10-10 Bill Labermeier W8PJY, Moderator
Connie Hauck K6EXQ, Speaker
John Hugentober N8FU, Speaker
NTS Forum Charles Gelm NC8Q, Moderator
Photovoltaic Power Paul J. DeNapoli WD8AHO, Moderator
Amateur Program Broadcasting Hap Holly KC9RP, Moderator
Digital Digest Dale Sinner W6IWO, Moderator
The New World of Amateur Radio Bill Pasternak WA6ITF, Moderator
Wayne Green Wayne Green W2NSD/1
Ohio Army MARS Albert W. Maddux AAA5OH/WA8CPB, Moderator
International Amateur Radio Network Glenn A. Baxter K1MAN, Moderator
Contest Forum Tim Duffy K3LR, Moderator
Slow Scan TV Dr. Don C. Miller W9NTP, Moderator
Passing the Code Loraine McCarthy N6CIO, Moderator
Firebirds Clarence "Hank" Easley WB9TUR, Moderator
Verle Winningham K8VW, Speaker
Bynum Usrey KA8GZI, Speaker
Dave Hansen N8BLX, Speaker
AMSAT Session 1 with Doug Loughmiller KO5I, Moderator
National Repeater Frequency Coordinators Forum George Waldie W8JRL, Moderator
Amateur TV Tom O'Hara W6ORG, Moderator
ARRL Len Nathanson W8RC, Moderator

Saturday Activities

0600–1700 - Flea Market Opens
0800–1700 - Exhibits open, prizes on display.
0900–1700 - Forums and scheduled activities.
1700– - Doors close for evening.
1930– - Hamvention Banquet (C.O.D. Bar open 1830).

Banquet The Hamvention Banquet will be held at the Convention Center in downtown Dayton. We are pleased to have Johnny Walker as M.C.

After a delicious filet mignon dinner, there will be entertainment and awards presentations followed by special banquet prizes. You must be present and have your banquet stub for this drawing. Seating is limited.

Sunday, May 1

ACC Owners Forum Ed Ingber WA6AXX, Moderator
SWL & Utilities Michael Harris, Moderator
WX Satellites Dave Latsch, Moderator
FCC John Johnston W3BE, Moderator
VHF/UHF Antenna Gain Measurements-Meadowdale HS Joe Burke WA8OGS, Terry Price WD8ISK, and other members of the Midwest VHF/UHF Society Measurement Team
A Weekend Novice Class Gordon West WB6NOA, Moderator
Amateur Radio and the Law James O'Connell W9WU, Moderator
Chris Imlay N3AKD, Speaker
AMSAT Session 2 with Doug Loughmiller KO5I, Moderator

Sunday Activities

0600–1600 - Flea Market open.
0800–1600 - Exhibits open, prizes on display.
0930–1445 - Forums and scheduled activities.
1500– - Drawings for major prizes.

Number 20 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
2310 Romayor Court
Pearland TX 77581

Welcome to the special amateur radio satellite issue! The launch of Phase 3C is scheduled for late May or early June, but the present satellites offer plenty of activity right now. Fuji-OSCAR-12 has had an excellent, predetermined operating schedule. It's a good ratio of normal analog transponder activity, PSK (phase shift keying) packet, and recharge time. RS-10/11 has been flawless and the two UoSAT spacecraft continue to transmit strong FM signals on two meters.

Transpolar Skitrek

There is an update on the Transpolar Skitrek and Project Nordski Comm since the April column. Rich Ensign N8IWJ, AMSAT's Science Education Advisor, distributed data on the Skitrek/Nordski program worldwide. His information package "Exploring the High Arctic from Your Classroom" has been sent to educators in Brazil, Venezuela, Australia, New Zealand, India, all of western Europe, and North America. Thanks to Southern Africa AMSAT President Hans van de Groenendaal ZS6AKV, more than 100 classrooms in South Africa also have materials for following the trek across the North Pole via the U-O-11 digitalker.

The expedition started on March 3rd at 0740 UTC. The initial team is composed of nine Russians and four Canadians. The Russians include group leader Dimitri Shparo UA3AJH, photographer and meal coordinator Alexander Belyayev, artist Fyodor Konyukhov, cameraman Vladimir Ledenev, physician Mikhail Malakhov, equipment organizer Anatoly Fedyakov, researcher Yuri Khmelevsky and radio operators Anatoli Melnikov and Vasili Shishkaryov. The Canadian contingent: navigator Richard Weber VE8RW, scientist Chris Holloway, cameramen Laurie Dexter VE8LD and Dr. Maxwell Buxton, M.D.

It may take as long as 100 days to make the trip from Cape Arctic at the northern tip of the Severnaya Zemlya Islands in Russia, across the polar ice cap, and on to Cape Columbia at the northern point of Ellesmere Island in the Canadian Arctic. While in Soviet jurisdiction, the official skitrek team callsign is UKØCI. The Canadian callsign is CI6UA.

Do not attempt to work the skitrek team. Battery life is limited and radio operation is reserved for communications with the designated support bases and expedition coordinators.

Each day the skiers trek for eight to ten hours, depending on travel conditions. Then, they set up the single twelve-man tent, have a meal together, and report via HF radio on the team's progress. In the mornings, a quick breakfast is followed by packing the tent and ELT (emergency locator transmitter) transmissions.

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NUMBER 04 PRIORITY 000 DATE 7TH OF MARCH TIME
12 HOURS AND 23 MINUTES GMT YOU ARE AT 81 DEGREES
56.6 MINUTES N AND 97 DEGREES 15.1 MINUTES E 73
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Figure 1. U-O-11 Digitalker format for reporting the Skitrek team location.

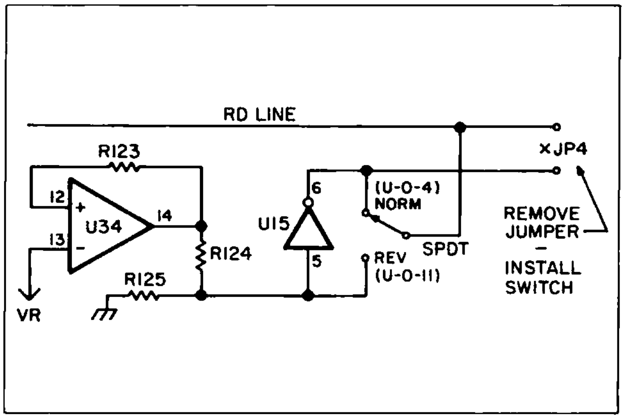

Figure 2. Hardware modification to the AEA PK-232 for U-O-9 or U-O-11 data reception.

Communication Support Bases

As reported in the April column, there are three of these. They are located at Resolute Bay in Canada (callsign CI8C), Sredny Island in the Soviet Arctic (callsign EKØQCG), and the Soviet Ice Island North Pole 28 (callsign 4KØDCG). Most of these locations are active on 20 meters after 1600 UTC. When they are not communicating with the trekkers, the support base operators will be available for OSOs. Most of the operators are avid DXers.

The Resolute Bay crew includes Garth Hamilton CI8HO, Andy McLellan CI8CW, Don Whitty VO1QF, and Glen Wyant VE3ICR. Others may also be making the trip to the upper edge of the North West Territories to help out at the support base.

At Ice Island North Pole 28, Barry Garratt VE3CDX/VE8CDX is on the air with the Soviet operators using the 4KØDCG callsign. Barry is using some of the ICOM HF gear from ICOM America.

Rick Burke VO1SA also has ICOM HF gear at the Sredny Island support base. EKØQCG (the station call) and EKØCR (Leonid Labutin UA3CR) have been heard on 20 meters. In addition, listen for Moscow stations UA3HR, UK3KP and RK3KP. In Canada, VE3AUM in Ottawa and VE3CDM in Toronto are involved in support communications.

UoSAT and Skitrek

To keep on the right track, the skiers use celestial navigation and the digitalker on board UoSAT-OSCAR-11. After a few modifications, U-O-11's voice/data format has been set. During a typical 16-minute satellite pass, a listener can hear the voice synthesizer two or three times. During the remainder of the pass, the satellite sends the usual 1200-baud AFSK telemetry.

Figure 1 shows a typical digitalker message. It is repeated several times. At the beginning of the trek, the messages included degrees and minutes in the location information. Later the format presented only decimal degrees, but the skiers preferred the degrees/minutes combination.

While the skiers are on the Soviet side of the pole, the Russian COSPAS Control Center calculates the latitude and longitude of the expedition. That information passes to the University of Surrey UoSAT Command Center in England, where operators uplink it to the U-O-11 computer. At first the information from the COSPAS center was transferred via voice, but later via telex. This hybrid communications system is the Nordski Comm part of the program.

On the Canadian side of the pole, the SARSAT (Search and Rescue SATellite) control center in Trenton, Ontario, is responsible for following the trekkers. The SARSAT center sends computed information to a coordination group in Ottawa. This group transfers the information via telex, through the facilities of Telesat Canada, to Surrey.

Check It Out!

Listeners can actually hear U-O-11 with an HT and a rubber-duck. I tried this on several occasions using an insensitive rig and a typical eight-inch-long antenna. Low-horizon passes were very noisy, but during passes with elevations over 25 degrees, there were several minutes of good-quality reception. There was no problem getting accurate copy on the skitrek team's location. From the car, using a longer trunk-mounted whip, signals on 145.825 MHz FM sounded excellent. With the HT, however, I had some control over the deep fades by moving the antenna around. This was not possible while mobile.

Once each day, the digitalker is updated to reflect the team's position at the beginning of their daily trek. Set the two-meter rig on 145.825 MHz and see what turns up in the evening hours between 7 and 11 PM. Good passes also occur in the late morning from 9 AM till after noon. The trekkers have had good copy using their ICOM µ2-AT radios at −45 degrees Celsius.

UoSAT-OSCAR-11

With all the excitement over the transpolar skitrek, it's easy to forget about one of the key ingredients to the Nordski Comm system, namely U-O-11. This satellite had its fourth anniversary in space in March. NASA launched it as a piggy-back secondary payload accompanying LANDSAT-5 into space. The orbit is polar and sun synchronous, with an altitude of 700 kilometers. This spacecraft was designed and built in six months by the UoSAT Spacecraft Research Unit at the University of Surrey, working closely with AMSAT NA and VITA members. U-O-11 has supported several different experiments, including digital store-and-forward communications, spacecraft attitude determination, stabilization and control, auroral particle-wave measurements, CCD (charge coupled device), camera imaging, and on-board computer operations. The skitrek activities show just one more possibility for the productive use of LEO (low earth orbit) spacecraft.

Starting Point - Cape Arctic:	81.25 N, 95.75 E
Ice Island North Pole 28:	87.80 N, 142.0 E
End Point - Cape Columbia:	83.10 N, 70.59 W

Table 1. Start and end points for the Skitrek team. Ice Island 28 is a communications support base.

AFSK Data

The satellite's computer sends a wealth of information during those periods between digitalker operation. Much of this 1200 baud AFSK data is telemetry, but it also forwards bulletins and DCE (digital communications experiment) transmissions.

The AEA (Advanced Electronic Applications) PK-232 offers an easy way to receive the 1200 baud data for those who don't have a Bell 202-type modem in the shack. UoSAT enthusiast Phil XE1FLF has been using his PK-232 to capture telemetry for later decoding and to keep informed on the satellite experiments at the University of Surrey via the bulletins. For UoSAT-OSCAR-9, the AEA unit is ready to go. Start by commanding the PK-232 to ASCII with WIDESHIFT on. Set ABAUD to 1200 and get ready for a pass.

For U-O-11, Phil provides the minor hardware modification to the PK-232 to enable it to accept the inverted data format from the satellite. The RXREV command that toggles the sense of the bits doesn't seem to provide proper decoding. The hardware change requires one switch (see Figure 2). The switch channels data through an existing inverter (for U-O-9) or bypasses it (U-O-11). Simply remove jumper JP4 near the external modem output and wire in the switch. Installation location is not critical.

Updates

Phase 3C is scheduled for launch on May 26th with two other spacecraft, METEOSAT and PANAMSAT. An additional mission, carrying a new Intelsat 5 communications satellite, is now in the May 11th Kourou line-up. The flights are renumbered accordingly, so the AMSAT launch is now V-23. The Amateur Satellite Report from AMSAT NA publishes many technical details of Phase 3C. Those who are not yet a member of AMSAT, or have let their membership lapse, should contact them at PO Box 27, Washington, DC 20044.

AMSAT-OSCAR-10 may soon be back in service. Ground stations continue to monitor the satellite in hopes that the latest hibernation period will end with no damage to the batteries or the Mode B (70cm up and 2m down) transponder. Check the AMSAT nets for updates and possible satellite operation in late May or early June.

Fuji-OSCAR-12 experienced a few setbacks to the ambitious two-month schedule presented by the JARL. Long periods of mode JD (2m up and 70cm down PSK packet) caused the satellite to shut down its transmitter early on several occasions. During some passes when the satellite should have been active, only a minute or two of downlink at most was heard. Recharge times have been extended to allow for good battery condition prior to each day of JD or JA (analog mode) activity. Some of the recharge cycles leave the memory on to hold the contents of the BBS system for the next active period.

The Soviet RS-10/11 combination satellite continues to give excellent Mode A (2m up and 10m down) operation. Mode K, with its 15 meter uplink, has been active with mode A most of the time. In March, however, there were some days when the 15 meter uplink was inactive. Many new stations continue to show up on RS-10/11 and signals have been great.

Be sure to catch the fine satellite articles in this issue, listen for U-O-11, and get ready for Phase 3C!

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73 Review

Number 21 on your Feedback card

by Brian Hastings KA1HY/AE

Creative Design Co., Ltd.
Orion Hi-Tech, Exclusive U.S. Distributor
PO Box 8771
Calabasas CA 91302-8771
Price Class: $239

Create CR-30 Roof Tower

73 Magazine is in the midst of erecting a satellite antenna system. We procured Creative Design's 10-foot roof tower, the CR-30, to use for this project. This review discusses the tower assembly only.

What It Is

The CR-30 is a two-stage, pyramid-type, square tower. It is nearly 10 feet tall when fully assembled, not including the vertical mast, and has a base width of 39". The tower uses a high-strength aluminum alloy for most parts, while zinc-plated steel is used for particularly critical elements.

The CR30 weighs a mere 15 kg (33 pounds) tower and has a wind load of 70 kg in 90 mph winds. Maximum vertical load and twisting torque are 600 and 4500 kg, respectively.

Since the four rubber-padded feet merely rest on the roof without bolting to it, the tower security rests solely in the guying.

Assembly

The instructions are very thorough and graphically well-supported. They recommend three or four persons for tower assembly, but my step-brother and I spent only an hour putting the CR-30 together. Assembly is very straightforward and requires only simple hand tools. The upper and lower sections of the tower assemble separately, and the builder must leave the bolts loosely tightened until it is time to fit the two sections together.

Guying

Guy wires are the tower's only securing system, so they MUST attach to the tower as high up the tower as possible, without interfering with the mounted antenna array path. Do not attach them to the tower at any point below the top of the tower's bottom section. We chose only to secure the guys at the very top of the tower using the four stay hooks provided. The stay hooks angle downward at approximately 45° for convenient placement of the guy wires.

Rotor Mounting

The tower comes complete with rotor and thrust bearing mounting plates, which are both pre-drilled to accomodate many common rotor configurations with Kenpro, CDE, and Create products. The rotor plate mounts between the top and bottom sections, and the bearing plate serves as the tower cap.

In Closing

The antenna system is not yet complete, but the tower spent the duration of our cold New Hampshire winter outside with no visible signs of corrosion. The quality of materials is apparent. The Create CR-30 roof tower is pricey, but it is an outstanding alternative to the cost and hassle of a full-blown, ground-mounted tower. It will support any antenna array most hams care to tangle with, and it's easy to assemble. The CR-30 gets two thumbs up.

Number 22 on your Feedback Card

PROPAGATION

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Ol' Sol

Readers may ask, "Why should earthlings be so concerned about changes on the sun?" After all, earth is located approximately 93 million miles from the sun. What kind of influence could a body exert over that distance?

Plenty! Sunlight, which travels through space at nearly the speed of sound, takes only eight minutes to reach the earth from its point of origin. Streams of sub-atomic particles bathe the earth daily. The solarsphere, analagous to earth's atmosphere, extends all the way to earth and beyond.

Not only does the sun's gravitational pull affect the earth and keep it in orbit; its ever-changing radiation influences Earth's atmosphere. Since the sun is so far from the Earth and yet affects it in so many ways, there may well be other influences affecting the earth—and maybe even the sun!

Planetary E-M

I believe there *are* other influences, and so did my predecessor John Nelson. John Nelson pioneered the use of planetary predictions. It stands to reason the solar system is practically a "closed" system except for occasional visitors from space, namely the comets. All else is contained within the sun's gravitational pull: planets, asteroids, dust, moons, and all of the other bodies contained in this solar spaceship. Just as the moon influences earth tides, the larger planets influence solar tides, and as these change with the positions of the planets, the sun's output changes. In other words, planetary positions influence or "modulate" solar conditions. . . both gravitationally and electromagnetically.

Very often the electromagnetic (E-M) effects are likely to be more powerful and influential than gravity. While it's true that large masses "bend" light almost imperceptibly, the effects about which I speak are far more pronounced—too much so to be merely the result of gravitational pull.

". . . planetary positions influence or 'modulate' solar conditions . . . both gravitationally and electro-magnetically."

Planetary Fields

The theory holds that planets having molten cores of nickel-iron have electromagnetic fields, which act as giant magnets. A simple compass tells the user that the Earth has such a field. The Earth's molten heavy-metal core, which doesn't rotate as fast as the lighter crust, produces this field. Space probes that have closely examined other planets in the solar system indicate that some of these also have such fields. These fields can act through space on other objects, just as the field of a bar magnet acts through space to attract iron filings.

To accept the possibility of numerous heavy objects with magnetic fields whirling in orbit about the sun is to admit that the sun may well feel powerful electromagnetic effects. This supposition is the basis of my forecasting method. I have gathered enough data over a 10-year period to convince me that planetary positions definitely affect the Earth and the sun.

The magnetic field of the Earth captures solar particles and concentrates them—like the iron-filing-and-magnet analogy—in definite patterns around the Earth. The Van Allen radiation belts prove this. The Earth's magnetic field is not constant. Its magnetic flux varies daily, sometimes concentrating more densely at the poles. Sometimes the field is quiet, and sometimes it is it is disturbed, even stormy. Under magnetic storm conditions, incoming solar particles often concentrate around the earth's poles, giving rise to auroras—ionization of particles by solar energy—near areas of strongest fields intensity.

Consider also that radio waves propagate along magnetic force lines. The Earth's magnetic field will greatly affect them. Thus, when the field is upset, the propagation along north-south lines (trans-equatorial propagation) is enhanced and the propagation along the east-west directions is diminished. When the field is very disturbed, resulting in "magstorms," the ionosphere is so over-ionized that it can no longer support reflection or refraction of radio waves. Instead, it absorbs them, converting them to heat or other forms of energy.

The monthly propagation charts in this column contain what I like to think of as "general" effects (the band-by-band summary of conditions and the maximum usable frequency or MUF for the month), and the "special" effects (the daily forecast of conditions based on the earth's magnetic field whose variations we've been discussing).

Therefore, to determine where and how to propagate your radio signals around the earth, take both the general and special effects into account. First look to see in general what the MUF is likely to be between the locations on earth over which the signal will travel, and pick the time of the day and frequency bands accordingly. Then check the daily forecast, which is based on the earth's magnetic field.

The daily chart, then, tells whether propagation will be (F)air, (G)ood, or (P)oor each day—based on my estimation of the magnetic field condition of that day—made two to three *months* in advance. ■

The editors of *73* are looking for another writer for our Propagation column. W1XU, who has been with *73* since 1984, will retire soon. If anyone is interested in taking over the Propagation column, write to Larry Ledlow, Jr. NA5E, Editor in Chief, 73 Amateur Radio Magazine, WGE Center, Peterborough, NH 03458.

MAY

SUN	MON	TUE	WED	THU	FRI	SAT
1 F–P	2 P	3 P	4 P–F	5 F–G	6 G	7 G
8 G–F	9 F	10 F	11 F–G	12 G	13 G	14 G
15 G	16 G–F	17 F	18 F	19 F–P	20 P	21 P
22 F	23 F–G	24 G	25 G	26 G	27 G	28 G
29 G	30 G	31				

Propagation Forecast

Spring propagation conditions will slowly turn into summer propagation conditions on the HF bands during the month of May. May is a transition month, which means that the excellent conditions of March and April slump a bit. The rapidly-increasing Solar Flux as a result of Cycle 22's continuing upswing, however, will offset this quite a bit.

Expect good DX propagation on all of the HF bands during the day and into the early evening. Twenty meters should stay open well after dark, with 15, 12, and 10 meters staying open until at least the twilight hours. On days when the geomagnetic field is quiet and solar flux is well over 100, expect 10, 12, and 15 meters to be really up and open until dark.

The first week of the month is expected to have a disturbed magnetic field with average to poor conditions for DX. The second week will improve with a few good days. The third week looks like it may be fair to poor, but the last week will be generally good to excellent.

Four out of five weekends ought to be good. Have fun!

ATV

Ham Television

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

ATV COORDINATION SNARE

This month's column deals with a very serious subject that has been plaguing ATVers for many years: QRM resulting from poor and irresponsible frequency coordination. The time is ripe for someone from the ATV community to tell it like it is. It will certainly be the hot subject among HamTVers this year at Dayton!

Non-Involvement from Up Top

The *problems* began a number of years ago when the FCC ceased the requirement of repeater registration by clubs, groups, or individuals. This decision alone opened the door to thousands of greedy FM repeater egomaniacs across the country, who had to have, own, and control a working VHF, UHF, or above repeater system of their very own, regardless of other systems already serving the designated area. Abuse of frequency coordinator authority led to pre-approval of "under-construction" systems, as well as hundreds of outright denials to others. Most FCs are very conscientious, but it takes just a few dishonest ones—those who place their own interests above those of amateur radio—to cause a lot of misery.

Many hams have sent complaints, accusations, and documented evidence to the ARRL and the FCC in regard to hundreds of flagrant violations by volunteer FCs. Pleas for help to K1ZZ and other ARRL Board Members concerning ATV QRM and denials of frequency coordination by FCs, have to date fallen on deaf ears. The League refuses to get involved in these matters in the apparent hope that the problems will go away, yet they give national publicity and official recognition to some frequency coordinators in each year's repeater directory, and even sponsor a national FC Newsletter.

The League can no longer dodge the growing and very serious controversy caused by FC mismanagement and short-sightedness. ARRL directors are now beginning to feel the heat and now discuss this dilemma at official board meetings. The League recently petitioned the FCC to do something about it at their level.

The FCC, however, has also refused to get involved in these disputes. Last fall, a southern office of the FCC stated that not only could "any amateur or group declare themselves an Amateur Radio Frequency Coordinator" but also charge fees for the coordinating administrative work! One Southern California amateur is now selling "coordinated frequencies" for $250 each!

Is this the future of Amateur Radio on the VHF/UHF bands?

National Issue!

Callers to the nationwide "Westlink Radio Network" telephone numbers (Los Angeles (213) 462-0008, Chicago (312) 289-0423, New York (718) 353-2801, and others) were amazed at a Roy Neal K6DUE headline story during the broadcast week of February 26, which highlighted the frequency coordinator problems between Al Crites WA9ZZU of the MAAC Illinois Repeater Council, and USATVS member Henry Ruh KB9FO and his in-band 70 cm ATV repeater project in Chicago.[1] The aired story related KB9FO's year-long battle to obtain approved frequency coordination for the PEACOCK Amateur Radio Club-sponsored Chicago ATV repeater on a nationally recognized 70 cm UHF TV operating frequency.

According to the broadcast, Al Crites WA9ZZU had not only been unresponsive to Ruh's request, but had indeed coordinated dozens of FM repeater links and systems in the lower 420 MHz band where ATV repeater outputs have been agreed to for in-band ham-TV repeater systems! In January, KB9FO hosted a personal in-home visit and ATV QRM demonstration to the chief engineer of the Chicago and Minneapolis/St. Paul FCC field office, as well as to the chief mobile enforcement officer of Allegan, Michigan. After several hours listening to the plight of the KB9FO year-long effort to get proper coordination approval, and after seeing actual documented correspondence files kept by Ruh, the Chicago FCC engineer stated, "Turn the system on!"

Further Investigation

The USATVS learned that the Illinois Repeater Council reviewed the case, admitted to problems handling workloads, and stated they had been without the help of an unlisted UHF frequency coordinator for a long time. They still refused to sanction, however, the coordination requests for an in-band ATV Repeater petitioned for by Henry Ruh. In answer to a second letter recently sent to Henry Ruh from Al Crites (after the broadcast), Ruh remarks, "We are dismayed at the lack of cooperation for our 420 MHz in-band frequency requests. Be advised that, provided we are able to overcome site and frequency pollution problems, we will be operating on in-band frequencies. The nationally recognized band plan allows for ATV repeater operation on frequencies specifically set aside for this purpose. That you or other band users do not want to cooperate is of no concern to us except to the point that we would hope that all band users would be accomodated."

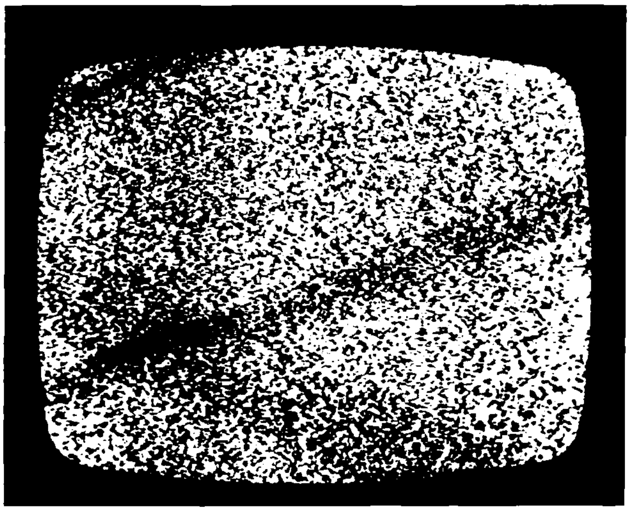
Ruh continues, "Placement of repeaters below 443.00 MHz has obliterated ATV operation for the ATVers who populate 439.25 MHz. This is nothing less than willful interference to existing band users by your coordination efforts and the operation of FM repeaters. Feel free to inform other band users that they will simply have to move to band areas set aside for links which do not interfere with nationally recognized ATV frequencies."

Ruh further cited a nearby ATV repeater under construction in Valparaiso, Indiana, on 439.250, and potential interference to the 439.25 simplex frequency.

The FCC, in an attempt to remain extricated from the matter, has also stated that anyone can declare themselves a frequency coordinator and advised the League that they must include recognition of these new FCs and any submitted system listings in any future editions of the ARRL Repeater Directory. This can help take away the abusive power of present FCs and help to defuse a potentially harmful situation. On the other hand, if out of control, it can lead to the destruction of the VHF/UHF bands as we *know* them today.

Pay & Play!

These problems aren't limited to the nation's northern major cities. USATVS member and Section Manager Vic Leisner W3LGV reported on February 22 about some troubles he and the Orlando ATV Repeater group have had getting proper frequency coordination from The Florida Repeater Council, Inc. Vic sent a copy of a letter dated January 1988 which announced the formation of 8 elected directors and a *council of* repeater owner or sponsor representatives. In the same letter, the Florida FC asks outright for donations to meet their rapidly rising $1,500 per year expenses. The tone of the strongly worded letter leaves the reader with the impression that if one does not remit a few bucks, their desired system may not get coordinated or stay coordinated. I quote from the letter, "As we have said in the past, ten dollars a year is cheap to insure an ongoing and viable repeater council that looks after your interests." The letter is signed by Thomas J. King WB4ILH, President, Florida Re-



peater Council, Inc. Further investigation by the USATVS revealed that one of the candidates running and being promoted by King for a position in control of the Florida Repeater Council is a friend of his, Gordon Williamson AB4CQ, who has a 442.75 MHz FM repeater output (against the national ARRL band plan) in Orange City, Florida. This frequency was assigned to the FM repeater output AFTER initial coordination approval was awarded to the Orlando ATV group. AB4CQ's system now wipes out all ATV pictures in central Florida! King also claims knowledge of only one ATV system in Florida. The latest USATVS ATV/R Database lists nine other operational systems!

Even more shocking is the FC's decision to create brand new FSTV repeater inputs and outputs inconsistent with others in the country. We quote from the Florida letter.

"Your letter/agreement is in reference to interference to ATV repeater operations in central Florida from AB4CQ (formerly KC4CI) operating a 70 cm FM voice repeater on 442.075 MHz in Orange City, Florida. The Council has been in contact with Mr. Williamson concerning this matter. At this time we are satisfied that AB4CQ is operating his system within accepted amateur and technical standards. The Florida Repeater Council recognizes that there is a definite interference problem between FM voice repeaters operating in the 442 MHz band and ATV repeaters with inputs in the 439 MHz band. The Council recognizes that this problem exists primarily for two reasons: 1. The occupied bandwidth of ATV (4.5 MHz) of which 3.5 MHz is above the 439.250 MHz input frequency used by most ATV systems in the United States. 2. The lack of proper frequency-use planning that came with the first ARRL 70 cm band plan.

"The Council recognizes the fact that there is only one ATV repeater pair available in the 70 cm band. Therefore, we are investigating several alternative ATV band plans. These include:

1. The inversion of ATV repeater pairs so their inputs are in the upper 420 MHz area. The impact on FM voice repeaters would be minimal, but they would totally alleviate the interference currently being felt by ATV systems.

2. The creation of two new ATV repeater channels. One pair would be 438.250 MHz in and 428.250 out, and the other would be 434.250 MHz in and 424.250 MHz out.

3. The elimination of ATV repeaters entirely from the 70 cm band There are currently 3 ATV repeater pairs in the 23 cm band with no overlapping modes of operations."

The Florida FC ends his letter in the closing paragraphs with ". . .the Council is compelled to deny your petition . ."

This ARRL-recognized frequency coordinator is clearly woefully unsuited for his position. He did not know of eight other ATV/R systems operating in his state. He strongly implied that unless annual dues are kept up to date the coordinated frequency might indeed be lost or uninsured. He did not know the correct bandwidth of a standard NTSC TV signal. He did not know the correct offset of the riding FM audio sub-carrier. He did not know that there is more than one ATV repeater ARRL-approved operating frequency in the 70 cm band. He didn't realize that inverting ATV repeater input/output pairs would worsen matters because of intruding and improperly placed FM repeater carriers. He didn't understand that the creation of 2 new ATV repeater input/output channels at the prescribed operating frequencies would never work since Channel 1's USB falls in the 432-MHz SSB operating area. Finally, he had the gall to suggest a God-like, written policy that violates the FCC's Part 97 Rules and Regulations by *banning* ATV from the 70 cm band in Florida!

Conclusions

If other ATVers are having problems such as these in Chicago and Florida, USATVS and *73* want to hear about it! They should document as much material as possible, and write to us about the QRM or FC situation. We can't promise favorable results, but we can promise to make one hell of a fight on their behalf for a good cause. See us at Dayton and the Friday and Saturday night Ramada Inn North "ATV Workshop" sessions. 73

'A copy of the broadcast is available to USATVS members. Send a blank cassette tape and a return mailer. Include $1 or stamp equivalent for postage.

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Looking West

Frequency Coordination in Perspective

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

The FCC decided not long ago to permit virtually anyone—ham or not—to set up as a repeater frequency coordinator as long as that entity could show that it had support from the amateur community of a given area. The decision, penned by former Special Services Chief Ray Kowalski, used a large number of ambiguous terms—enough to wipe out two decades of work by unpaid volunteers to bring harmony to our VHF and UHF repeater subbands. Before you go off muttering about how rotten a move this was, however, please consider this insightful discussion by George Waldie W9JRL, whose article appeared in the January 1988 issue of the *ARRL Repeater Coordinator Newsletter*. He talks about the events leading to the decision, and proposes a plan to fix these ills. His excerpted article appears below.

Coordination Bedlam??

For more than three years Ray Kowalski has cautioned amateurs to do something about their coordination machinery—or else. On the eve of his departure from the FCC, Ray uncovered a part of "or else" means.

The immediate cause of this bombshell is a long-running dispute between two Southern California groups, the 220 Spectrum Management Association (220 SMA) and the 220 MHz Frequency Coordination Commission (220 MHz FCC), over who should coordinate 1-1/4 meter repeaters in their region. Material submitted by these two groups showed about 520 amateurs supporting 220 SMA and about 215 favoring 220 MHz FCC. In light of the "substantial" support for each organization, the FCC declared that it could not rule for or against either. They will have to find some way of co-existing in the same coordination area.

The notion of two competing groups issuing coordinations in the same territory boggles the mind. It is patently unworkable. If the degree of cooperation and goodwill needed to make this work existed, these Coordinators would merge. That the matter has come to this state argues against that.

The purpose of this discussion is not to dissect this particular issue. Hams must ask, "How did we ever let this get to such a point?" Amateur radio has had three full years, since Louisville '85, to figure a way to safeguard against such problems. Kowalski even *then* told us that organized groups of Coordinators could pass on the qualifications of their members and issue credentials. This same message was given as recently as last September. Writing to Steve Mendelsohn WA2DHF about the then upcoming meeting of Northeastern Coordinators, Ray said:

"During this meeting, the coordinators will recognize each other as valid coordination bodies in the Northeast. I applaud the effort, because it will provide a valuable means by which the FCC could determine the legitimacy of any particular coordinator, should the need arise. This is a completely valid approach, one contemplated in PR Docket 85-22, paragraphs 13 and 25. But it does not depend upon FCC presence for its validity, and I wish to avoid the appearance that it does. Amateur repeater groups in all parts of the country may engage in similar, regional meetings and be assured that their resulting certifications of legitimate repeater coordinators will be recognized by the FCC, regardless of whether anyone from the FCC attended the meeting."

So, amateurs have had available to them an approved method of dealing with coordination problems since April 1986, when the FCC issued Report & Order on PR Docket 85-22. What have we done about it? Well, Coordinator Conferences now cover many areas east of the Mississippi, and a substantial piece of the Midwest. Amateurs, however, need to do much more.

Ray Kowalski also writes again in the letter to WA2DHF.

"As part of the process, I would urge that some thought be given to the procedures for handling changes in circumstances. People involved in repeater coordination today may grow weary of it tomorrow, key people may relocate, a group may be lax in following standard procedures or may become controlled by corrupt individuals. The point is: There should be a way to modify the actions your meeting will take next week."

The regional Conference should be prepared to give peer review to the actions and performances of its members. It is a logical step to expect the Conference to provide mediation/arbitration to conflicts between members. Applying such measures early would reduce festering wounds that protracted combat produces.

> ***"For more than three years Ray Kowalski has cautioned amateurs to do something about their coordination machinery."***

Note that there is nothing here to suggest that Conferences should be devices for protecting members against legitimate grievances of their constituents. No Coordinator should operate except with the approval of a majority of the hams in its territory. The Conference should strive to maintain this standard. No Coordinator should ever be allowed to feel above or beyond the judgment and sanctions of its constituents and peers.

Back To California

Would this approach solve the California problem? I doubt it. Amateur radio must use this method before the problem arises.

This particular sort of conflict imposes a stern duty on Coordinators to protect the repeater operators in their area. Returning to Ray's communication to the California groups:

"The existence of two recognized frequency coordinators with overlapping responsibilities in the same geographical area creates a potential for conflicting coordinations. . . "If inconsistent coordinations lead to mutual interference between amateur stations in repeater operation, then the licensees of both stations will be held equally responsible under Section 97.85(g) of the FCC rules for resolving that interference. If interference in such a circumstance is not resolved, the result may be violation notices and/or monetary forfeitures for violation of Sections 97, 78, 97.85(g), and/or 97.125 of the FCC rules. In such a circumstance, these violation notices or monetary forfeitures could be directed against the licensees of the station in repeater operation as well as against the licensees of stations that originate transmissions that are repeated. . ."

The Coordinators feud, and the penalties land on the operators, who are the pawns in the game!

The message is clear: the FCC does not intend to referee our squabbles. Hams must stop wringing their hands and crying that "they" ought to do something. "They" is us. If this precedent of having two operating Coordinators in one territory is allowed to stand, we will see "rump" coordinators springing up wherever there is a trace of dissatisfaction, resulting in intolerable confusion.

Coordinating is indeed not a simple task. It requires large-scale organization for record-keeping, planning, and public relations. The right way to end ineffective or improper coordination practices is to vote out and replace individuals deemed at fault, and salvage the basic organization.

The Criteria Proposal

Back in 1985, Corwin Moore WB8UPM, and Steve Mendelsohn WA2DHF, wrote a set of "Proposed Criteria for Repeater Coordinating Councils" aimed at defining coordination bodies that would meet the necessary tests of representative, effective, and fair operations. Steve published the Criteria in the *Repeater Coordinators' Newsletter* and evoked a bored yawn from the coordination community. The loudest protests will flow from those same mouths, however, when they discover a rump coordinator in their back yard!

Let's face it—many folks will interpret the FCC's latest action as a license to go into business for themselves. The FCC's message is "clean up your own mess, we don't intend to." If hams fail to, they and Amateur Radio will be the losers.

Continued on p. 99

So what do we do? Why not start with the Conferences? We can go with what we presently have. Prove they can do the job and they will expand to cover the country. Each Coordinator will have to give up a smidgen of its autonomy, but they should keep bearing the alternatives in mind. This proposal at least allows territories with common problems of terrain and geography to develop their own methods of treatment.

Then look at the Criteria (I can supply a copy for an SASE). The proposal is excellent, but I propose a few additions.

—Accommodate Coordinators operating outside Council structures.

—Acknowledge that Coordinators are responsible not only to their own constituencies, but also to those territories on which their actions impact.

—Each Conference can alter the Criteria to fit its own circumstances, to arrive at a statement of operations for its members. Those who can show they conform to the adopted Criteria, are confirmed as Coordinators until a challenge arises.

"... the FCC does not intend to referee our squabbles."

—Each Coordinator should file with its Conference a definition of its geographic coverage area. Where conflicts between Coordination areas are found, the Conference should see they are resolved.

—Each Conference should adopt methods by which dissidents within a Coordinator's territory can bring their grievances to the Conference after all of the Coordinator-supplied recourses are exhausted. This is the time for the Conference to supply mediation/arbitration services by persons from within or outside the Conference region.

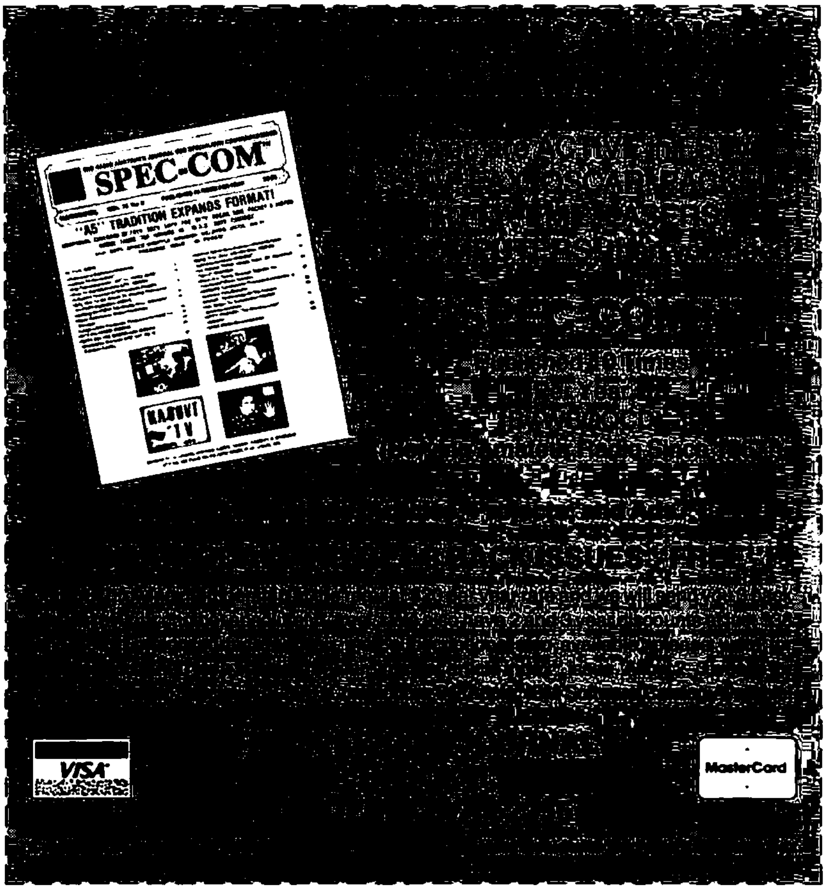
Even for the initial arrangements of the Conference, the distances involved may mandate that actions be taken by correspondence, phone, or letter. Conferences need not be highly organized bodies. Most of the functions will be procedures in place to cope with eventualities, some of which will seldom or never arise. However, the Conference should be prepared to act promptly and decisively early in the development of any dispute, before irreparable damage is done.

I feel that if amateur radio above in time, the Southern California situation may well have been resolved before now. It would have been forced to a solution by the amateur community at an early time, with the weight of peer pressure to make the solution stick.

We were warned at Dayton '85 that if coordination became a problem for the FCC, we would not like the solutions they would adopt. Certainly, the Southern California 220 situation, and the FCC response to it, is not one I like. It does no good, however, to rail at the FCC. The League's well-meant effort to serve repeater users with the *Repeater Directory* has put it smack in the no-win middle of this disaster. If we are not to see more of these problems, we better take steps to treat such cases in their infancies. We fail to do so at our peril.

Epilogue

George Waldie W9JRL is in the fortunate position of being away from either coast, and better placed to view the coordinate chaos with an unprejudiced eye. The main problem is whether or not its too late to implement George's sensible advice. It has been five months since Kowalski handed down his decision, and the conflicts have grown worse. In some cases and in some places, it will be decided by a judge. That's all for now from those of us who write the late shift from Los Angeles... de WA6ITF



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MACKET: packet program for the Macintosh, $39.95. Write for details. S. Fine Software, P.O. Box 6037, State College PA 16801. BNB733

LABORATORY Equipment, Electronic Test Equipment, Components, Unusual items. Industrial and Government Surplus and priced Cheap! Send 50 cents for catalog to: Lehman Scientific Equipment, R.D. 1, Box 580, Wrightsville PA 17368. BNB734

WILSON MARK IV 2 METER HANDHELD. Lots of extras. KA3W, 12518 Montellano Terrace, San Diego CA 92130. 619-481-9028. BNB735

INTEGRATED CIRCUITS DATA BOOKS for sale. Business size SASE, seven page list. C. Frazier, Box 972, Windermere FL 32786. BNB736

HAVE THAT OLD HEATH radio gear reconditioned, aligned, calibrated. SASE for quote. RTO Electronics, 4166 Maple St., Berrien Springs MI 49103. BNB737

TEACHERS AND STUDENTS interested in talking to other teachers and students via ham radio, please contact Karen KB6DDQ at PO Box 925, Frazier Park CA 93225. BNB738

WANTED: DM-34, DM-35, DM-36, and/or a DM-37 Dynamotor P/O Radio Set SCR-508, 528, and a PE-157 Power Supply for SCR-511/BC-745, will pay top market price. CONTACT Wm. A. Stokesbury, 305 W. 142nd St., Ocean City MD 21842. BNB739

YOUR CALLSIGN ON A 10-OZ. CERAMIC MUG with the ARRL logo. 1/$5.95, 2/$10.95 (different calls allowed). Send check to: CSCUPS, Dept. C, POB 17062, Raleigh NC 27619. NC residents add 5% tax. 5 weeks delivery. Send for club specials. BNB740

Number 27 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

More Letters!

Here's a letter from the bottom of the pile from Howard H. Halperin N7ETP of Phoenix, Arizona. Howard says that he has a TRS-80 Color Computer 2 connected to a Kantronics TU and a Heathkit Crossfire scope. He said that he can usually get pretty good copy on his RCA monitor, but wants to know how to transmit.

At the risk of sounding smart-alecky, Howard, a transmitter will do the trick! The Kantronics, assuming it has an audio (AFSK) output, connects to the microphone input of most any transmitter that covers the frequency desired. Just hook it up and go for it. This is an old letter, so hopefully Howard is on the air right now, but sometimes the apparently obvious eludes the best.

There is another letter from fellow Marylander Bill Thompson. His question is universal: he's looking for a CP/M based RTTY program.

Sorry to say, this columnist knows of none. The emergence of smart terminal units, such as the AEA PK-232 and Kantronics KAM, may well spell the end of many of the purely software approach to get computers onto RTTY. After all, there are a plethora of ASCII-based terminal programs for most computers. Many public domain programs are excellent. Two that come to mind immediately are QModem SST for the PCompatible crowd and MickeyTerm for the TRS-80 Color Computer. Either of these, or similar, and one of the smart terminal units, sets a user up on easy, intelligent RTTY.

If there is a public-domain CP/M-based RTTY program floating around in the readership, please send it in for the benefit of all.

Not only the CP/M crowd looks for public-domain RTTY stuff. A note form Gene Elfstrom WB2NIE says that he's interested in a public domain program for the Commodore 64.

Gene, look at the CompuServe SIG devoted to the Commodore—there's at least one such program in the database. Those who have other sources, please let RTTY Loop know!

I have a forwarded question for a RTTY program for the Commodore 128, from Lucien TR8RLA in Libreville, Gabon (Africa). Again, I have nothing in this regard. Here's one fellow I know would appreciate any help. I'll hold onto his address, and forward anything RTTYers send me. Jerry Felts NR5A/Ø issued a similar request for RTTY software for the Atari 130-XE.

Well, folks, are true RTTY software programs passe? Do only dedicated microcomputer controlled terminal units lay in the future?

A few topics covered in past columns seem always to be on someone's "wish list." There is a letter, for example, from Steve Smith WA6SOC San Francisco, CA, who is looking for low-cost demodulators to hang between a receiver and C-64 computer. These, and many more topics have been covered in the over eleven years of this column. I have prepared an index to all of these to be had only for a SASE with postage for two ounces on it. Who knows what treasures are hidden in the collection.

> *". . . there are a plethora of ASCII-based terminal programs for most computers."*

Back to Basics

Many recent questions sent into the column, and interest in reprints of some of the early editions of this column show that there are a great many newcomers to RTTY. Likely due to the influx of computerized RTTY equipment, many of these amateurs have no idea of some of the basic elements of RTTY. Therefore, the columns over the next few months will include a little bit of review, refresher, or new material, (depending on reader orientation). Readers should send in any topics they want covered in this mini-series.

This month's column addresses the questions: "Where does one find RTTY?" and "What does one do when it's found?" On the HF bands, the two great concentrations of RTTY stations have traditionally been on 80 meters, at around 3620 kHz, and on twenty meters, at around 14.080 MHz.

This is not to say that RTTY doesn't exist on ten, but try the hot spots first. For example, as I write this column on a Sunday evening in January, there are at least ten or so RTTY signals between 3600 and 3650 kHz, and about the same number clustered around the 14.080 MHz marker on twenty. Now, not all of these stations transmit old-fashioned 60 wpm Murray (Baudot). I hear a few ASCII stations, and one or two that may well be AMTOR. The point is, here is a place to at least find something to tune in, to listen to, and to get used to the various "sounds" of RTTY.

Just for quick clarification, although the old five-level code used in Teletype machines of the Model 15, Model 19, and Model 28 vintage is commonly called Baudot code, it is really Murray code. The explanation is too much for now, but suffice it to say that common usage has prevailed over correctness.

VHF RTTY is more spread-out. Listen around on some of the local repeaters and simplex frequencies to try to get an idea of where the RTTY is in your neighborhood. Often a local club is known for its digital work, such as the BRATS club here in the Baltimore area, and they support RTTY activity on their repeater or on a specified simplex frequency.

Here's a crucial difference. Standard convention has it that on HF, the two frequencies used to represent mark and space, which form the FSK (Frequency Shifted Keying) signal are ordered such that the space is the lower frequency, and the mark the higher. The mnemonic used to remember this is LS/MFT, Low Space Means Fine Teletype. When you decode this signal, you should tune it as though it were a lower sideband signal, so the lower frequency space tone is farther away from center frequency, and thus generates a higher beat note. The lower space FSK signal generates a high space, low mark audio (AFSK) signal. Even on twenty, where upper sideband is more commonly used, tune the FSK signal on lower sideband, otherwise your resultant signal will be upside down, with mark and space reversed.

On VHF the tones used are audio already, so the convention reverses the mark/space relationship, to simulate the decoded FSK signal. Therefore, on VHF, expect to see a low mark rather than low space.

There is much more to cover in the "Back To Basics" vein. Stay tuned for future installments, and, again, let me know what you'd like to see.

Whoops!

Several readers commented on difficulties in the program listings from the January 1988 RTTY Loop, for the Super RTTY program for the Color Computer. The difficulties arise in the way that the typesetting machines handled the listing I supplied. Thanks to William Boneta, of Vero Beach, Florida, here are the errors I know about, as of now. First of all, the funny-looking raised dot in several lines should be an asterisk. The @ sign in several PRINT @ statements was omitted. PRINT A+32,"" is PRINT @A+32. Finally, in the RTTY.BAS program, line 380 reads IF C6, where it should say IF C<6; and line 390 says IF A$>CHR$(13) where it should be a statement of inequality, i.e., IF A$<>CHR$(13). May these come out correctly this time.

If all else fails, remember that the complete listing is still available on Delphi, in the Color Computer section (GROUP CO-CO), or I will be happy to put all of the files on a disk you send me with $2 and a stamped return mailer. Tape users may take advantage of the same deal, two bucks, a tape and mailer, and I will load the needed RTTY.BAS and MAKERTTY.BAS files to make a RTTY tape.

Some have asked how to create a TXT file for the transmit buffer to load. Use saved received text, or use any word processor or similar program to edit a text file. If there is sufficient interest, I could run a simple BASIC text editor here for those who do not have such an animal in their menagerie. ■

Number 28 on your Feedback card

AERIAL VIEW

Antenna News

Arliss Thompson W7XU
7413 SW 28th Avenue
Portland OR 97219

ARE DIPOLES ONLY BIDIRECTIONAL?

Imagine sitting at home some Sunday afternoon when there is a knock at the door. A young Novice friend, Jim, has dropped by for some advice on his antennas. Jim has been doing some reading about dipoles since erecting one on 80 meters a few weeks ago, and now he has some questions.

"I managed to get my antenna up pretty high—40 feet or so—and it's running north-south. It seems to work okay, but I have been looking at some antenna patterns and discovered that a dipole gives maximum signal off the sides of the antenna. That means that most of the power is being radiated to the east and west. The problem is that I have a schedule next week with a ham friend about 200 miles to the north, which may not come off since he's off the end of the antenna. I'd like some help putting up a new antenna running east-west, or change the current one so this friend can hear me. Maybe I should put up a vertical. Advise me."

What should Jim do? Does he need a second dipole? Compared to the antenna he has now, how much better would the second antenna work to the north and south, assuming they are equal in height? What if Jim doesn't have room for another dipole? Should he squeeze in an inverted vee in the space available? How about a vertical—would its omnidirectional pattern outperform Jim's dipole to the north, where he is most concerned with his signal strength? What *should* Jim do?

Many hams would advise that should Jim erect a second dipole if he had the room and can afford the coax. Those hams would probably defend their conclusions by citing diagrams of dipole radiation patterns similar to the one Jim referred to (see Figure 1). Based on what appears in Figure 1, it's easy to conclude there is no significant radiation off the ends of a dipole.

Figure 1, however, is misleading. It represents the pattern in one plane only (at zero degree wave angle in this case), and so does not tell the whole story. In fact, at certain wave angles the radiation in the direction of the wire will not be significantly different from that broadside to the antenna. Under some circumstances dipoles (and inverted vees) are essentially omnidirectional. Under those conditions, changing the orientation of a dipole has no effect on the signal strength in a given direction. Jim and many of the rest of us should then first learn under which conditions is a dipole omnidirectional.

Grab a Doughnut

One of the shortcomings with diagrams such a Figure 1 is that they seek to show on the 2-dimensional page something that actually exists in 3 dimensions. Most of us have at least some difficulty visualizing a 3-dimensional shape when given 2-dimensional views of the object, so a 3-D model is very helpful.

> *"Low antenna heights tend to reinforce high angles of radiation while producing cancellation of low-angle radiation."*

Before proceeding with this discussion, find a doughnut, or at least conjure up an image of one. With this model, the thicker the doughnut in any given direction, the greater the signal strength radiated in that direction.

Figure 2a shows how the wire of a dipole is related to its "doughnut" radiation pattern. Slicing the doughnut along the plane marked "1" in Figure 2a (take a horizontal cross-section), gives the pattern shown in 2b. Note that this is identical to the pattern shown in Figure 1, and, as mentioned before, is for a wave angle of zero degrees.

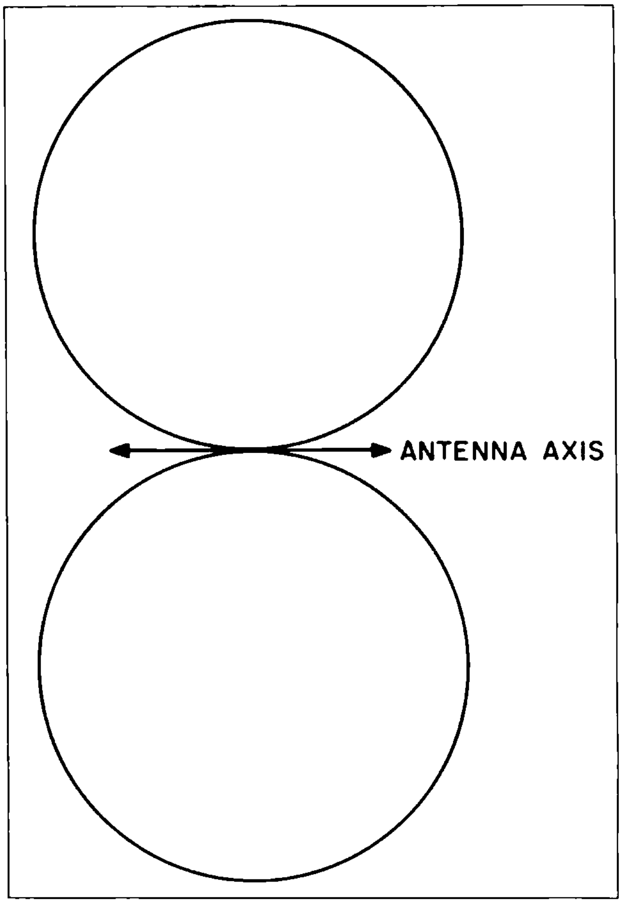


Figure 1. Horizontal directional pattern of a half-wave dipole.

Now imagine again the whole doughnut, and this time cut it along the vertical plane shown as "2" in Figure 2a. Note that with both the horizontal and vertical cross sections through the doughnut there isn't much doughnut (i.e., there is little signal radiated) along the wire axis of the dipole (line OD in Figure 2c). But look at the amount of doughnut shown at a high vertical angles of radiation (line OE) in Figure 2c. It's not much less than the maximum (line OF) being radiated from the antenna. Figures 2a–c, and the hand-held doughnut model should make it clear that while maximum radiation from a dipole occurs at right angles to the wire (including straight up), there is also significant radiation in the direction of the wire axis at high wave angles.

The reader may ask at this point,"Is that high-angle energy any use when it comes to communicating?" The answer depends on a number of variables. The two important variables are frequency and the distance between the two stations.

Frequency is important, because signals at lower frequencies are more readily returned to the earth at high angles of radiation than are higher frequencies. For example, energy radiated at an angle of seventy degrees above the horizon will almost never be returned to earth when the frequency is 28 MHz, but it commonly is at 3.8 MHz. The distance between the stations is important, because the greater the distance per hop, the lower the optimum angle of radiation. Information on the latter topic is contained in several sources, including the *ARRL Antenna Book*. In Jim's case, where the stations are 200 miles apart, the optimum wave angle will be greater than 50 degrees under average conditions.

Real Life

Keep in mind that the above-discussed dipole is in free space. Looking again at the doughnut model of Figure 2a, note that just as much energy is radiated down from the dipole as is radiated in the up direction. In real life, of course, the dipole is not in free space but is relatively close to the

The Lessons Here

1) The radiation pattern from a dipole varies with the wave angle in question.

2) There is significant radiation along the axis of a dipole at high-wave angles.

3) High vertical angles of radiation are optimum for communications over distances of less than, say, 500 miles on the lower HF bands.

4) Low dipoles radiate best at high wave angles, and are essentially omnidirectional at those wave angles. Specifically, the signal off the end of an 80-meter dipole under 60 feet high will be less than an S-unit weaker than the signal broadside to the antenna for receiving stations within 500 miles of the transmitter.

5) In an area with poor ground conductivity (desert, etc.), the amount of high-angle radiation from a low dipole can increase with ground wires parallel to the dipole. These wires should be ½ wavelength plus 5% in length. Theoretically, several such wires could be located on the ground within a radius of 60 feet or so, but whether the improvement (probably less than 3 dB) in signal strength would be worth the effort is debatable.

6) Dipoles show improved radiation at low-wave angles when erected more than ½ wavelength above ground. Those heights are easier to achieve on the higher frequency bands bands, and coincidentally, the lower wave angles are of greater importance at those frequencies. Also, dipoles are inherently more directive at low angles of radiation than at high angles. Therefore, while the orientation of an 80-meter dipole at 40 feet is irrelevant under most circumstances, a 10-meter dipole at the same height will show significant directivity at the wave angles most important for commu- nication on that band.

7) For the most part, the above statements also apply to inverted vees and beams.

ground. That means all the energy that is radiated in a "down" direction will eventually strike the earth and then be either reflected or absorbed, according to the characteristics of the ground itself. An excellent reflector such as salt water returns nearly all the RF striking it, while a ground

"Dipoles show improved radiation at low-wave angles when erected more than ½ wavelength above ground."

of poor conductivity, such as desert soil, absorbs much of the incident RF. If a dipole is situated at the proper height over good ground, the energy reflected from the ground adds in phase with the energy coming directly from the antenna. Under those circumstances, the effective radiated power at certain wave angles will be increased (as much as several dB) relative to that of a dipole in free space. Those wave angles vary with the height of the antenna. There are tables, graphs, and formulas available that allow the calculation of heights that produce maximum reinforcement at a given vertical angle of radiation For now, however, it's sufficient to know that low antenna heights tend to reinforce high angles of radiation while producing cancellation of low-angle radiation.

Jim may now lament, "But my antenna is high, at least 40 feet above the ground." Forty feet does look high to someone dangling from a tree limb, but look at it in relation to operating wavelength. Forty feet on 80 meters is less than a quarter wavelength high, so Jim's antenna is actually quite close to the ground. The quality of the ground near a low dipole has a significant effect on how well the radiation is reinforced at various angles. If Jim has an average location, his dipole will have relatively little radiation at low wave angles while proving to be quite efficent at radiating high-angle signals.

My advice to someone like Jim? It would be a waste of his time and resources to erect a second dipole or inverted vee at right angles to his present antenna. His current antenna is omnidirectional under the circumstances given. Although I did not discuss the use of a vertical, such an antenna, while omnidirectional, would be a poor choice in this instance (inefficent high angle radiator). If Jim lived in an area of particularly poor ground conductivity and had an interest in experimenting with antennas, he might try placing some reflectors on or near the ground (as described earlier), but this may well not improve his antenna performance significantly.

Go ahead and eat those doughnuts now.

Other Business

Several readers contacted me with questions or comments regarding the January "Aerial View" column on parallel dipole antennas with capacitive "baluns."

First, the diagrams showing how the feedline and antenna wires are to be connected are correct. Table 1, however, does contain some errors, including calculations for the 12-meter band based on a frequency of 25.9 MHz rather than the correct 24.9 MHz. Technically, the values in Table 1 are for 52 (not the indicated 50) Ω coax, but given the tolerance of feedline construction and other variables, that error should be insignificant. The formula to calculate the necessary total capacitance (C, in pF) that should appear either side of center for a given frequency is:

$$C = \frac{1 \times 10^6}{2\pi fZ}$$

where f is the frequency in MHz and Z is the impedence of the coax. For those unable to obtain the reference I cited, more information is available on these antennas in an article by the same author in *Ham Radio*, May 1987, pp.69–78. ■

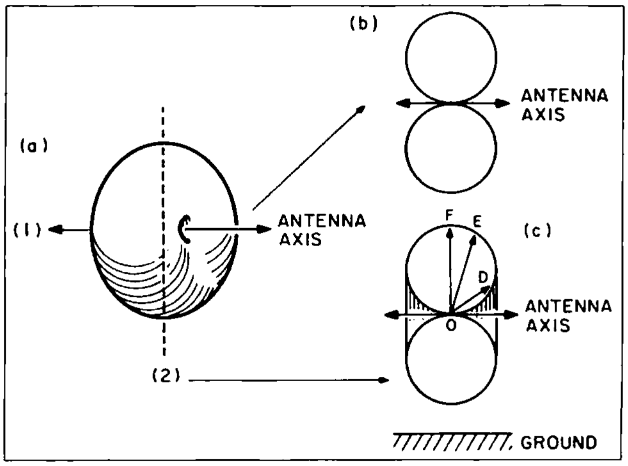


Figure 2. Representation of the 3-dimensional radiation pattern of a dipole (a). Horizontal (b) and vertical (c) cross-sections through the pattern are also shown.

Continued from page 13

Traffic

Traffic handling, whether by traditional means of nets and liaisons, or by digital and automated systems, cannot help but be greatly enhanced and streamlined by having satellites as a backbone to the network. Phase 3C promises to provide the quality and quantity of communications required of such a backbone. Phase 3 and 4 satellites added later along with low and high orbit packet forwarding systems will make possible order of magnitude improvements in current traffic systems.

Emergency Services

The same is true with emergency communications, nets, and drills. The Phase 3C satellite will not be, by itself, a 24-hour, worldwide access system, but it is a large step toward that goal. For emergency operations, high orbit satellites are like repeaters with hemisphere-wide coverage. Segments of the transponders can be dynamically allocated to emergency operations and operators at the disaster site can easily have excellent links to support stations thousands of yards to thousands of miles away in the same network.

Emergency stations already contain some combination of HF, VHF/UHF, analog, and digital modes. Addition of modest antennas and equipment for satellite capability should not be unreasonable in the Phase 3C era.

Education

Probably the most important public service of amateur radio is training and education, and OSCARs can significantly broaden the opportunities for technical education available. Society probably doesn't appreciate the amount of technical knowledge and expertise made available to it as a direct or indirect result of people's interest in amateur radio.

Amateurs, through their hobby involvement, know something about electronics and electromagnetics, legal matters including international regulations and treaties, and standard communications practices. Amateurs involved in the satellite service tend also to know something about physics, ballistics, and digital electronics.

At primary, secondary, college, and graduate levels, the subjects that constitute amateur radio and satellites of all types are interesting to many students. There are limitless opportunities for hands-on or direct observation of events via amateur radio that reinforce a knowledge of geography, culture, physics, mathematics, languages, computers, chemistry, and other subjects. Amateur satellites offer expanded opportunities and simpler, more profound demonstrations.

Photos and discussions of real satellites have fascinated students of all ages. Their imaginations are captured by descriptions of where the satellites are right now relative to a classroom globe. With a two-meter FM receiver, a class is able to hear an astronaut orbiting overhead or a scientific satellite sending telemetry. With a little more equipment, this can be expanded to pictures from a space shuttle or numbers in a telemetry chain ready for collation and interpretation. With a sideband receiver, students can hear amateur operators from around the world, and with the complimentary transmitter may even speak with them and become acquainted.

In the world of satellites, frequencies are higher so antennas and associated portable stations can be smaller. And, as I've already pointed out, the Phase 3C satellite promises to make this sort of demonstration easy and potentially commonplace. Of course, facilities and their educational uses can be extended as far as the students want to go, but this isn't necessary for meaningful introductory work.

Phase 4

Digital Signal Processing (DSP) is at the forefront of amateur radio today. Satellite operators are pioneering DSP, which will be used both by satellite users and by the satellites themselves for everything from selective gain control in the passband to specialized, dynamically adaptable modems.

Among the Phase 4 goals are transponder space for Amateur TV, direct broadcast of bulletins and appropriate announcements to entire hemispheres at a time, linking of terrestrial repeaters at continental distances at user request, experiments with digital TV and data compression techniques, and spread spectrum.

Phase 3C has one of its transponder outputs at S-Band, the 2.3-GHz amateur allocation, in anticipation of Mode-S operations for Phase 4. Since it is possible and practical to do so, amateur transponders will use higher and higher allocations to promote significant utilization of these amateur bands. Those who worry, (and with cause!) about losing valuable amateur spectrum in the future, OSCARs provide one of the best ways to stake out, and so defend, these frequencies.

Space Mobile

There have already been been two manned space missions where amateur radio was an active leisure activity. Any amateur radio station on a US manned space station will probably rely heavily on high orbit amateur satellites as communications relays. QSOs here will commonly last for more than half an hour. Amateur satellite capabilities are one of the best ways to prepare for QSOs with the astronauts, direct, or via satellites.

Project Assistance

Amateur satellites are often involved in international events, like the Skitrek polar expedition currently in progress. They have been also used to actively foster international cooperation. One example is the Search and Rescue Satellite system (SARSAT) which listens for Emergency Locator Tranmitters from polar orbit and allows timely location of the distress transmitter. OSCAR 7 proved this system concept.

How to Get Into Satellite Operation

The cost of an OSCAR 10 class station is roughly comparable to the cost of a standard HF station. The basic equipment list includes sideband and CW transceive capability at 145 and 435 MHz. Such equipment is available either as separate or combined units. Each receiver should have a low noise preamp front end, preferably but not necessarily mounted near the antenna. Single, circularly-polarized antennas with 10-15 dB gain for each band are sufficient with 25-watt range power levels. The ability to switch between right-handed and left-handed circular polarization from within the shack is as much a necessity with today's available satellites as are full elevation and azimuth antenna controls. One also needs some kind of tracking system, preferably an inexpensive computer.

Setting up a satellite station from parts is no more complex than setting up an HF station with a tower, beam, and rotator, but there are more steps and more calibrations. One should also use low-loss coax, particularly for UHF-and-above frequencies, unless the antenna-radio run is twenty feet or less.

Every part of such a standard system, and some advanced features such as computer controlled antennas, are available commercially in "ready-to-go" packages. As with any amateur station, there are many modes and routes of enhancement. These depend on the operator's personal goals and operational desires. Receivers or transmitters for other bands (15 and 10 meters, 23cm and 13cm currently) are probably the most expensive single improvements. HF-station owners should consider an additional route to get on satellites—transmitting and receiving transverters. These are available for virtually all VHF and above bands.

Those who own an FM receiver for the two-meter band can get started with satellite operations in virtually no time at all. Tune to (or buy a crystal for) 145.825 MHz wait for at most a few hours to hear several minutes of UoSAT digital data or the digitalker.

Ten-meter SSB rig owners should listen between 29.35 and 29.45 MHz. One can hear, from four to six times a day, the Soviet amateur satellite pair RS-10 and RS-11 (a pair of transponder systems on a single satellite) relaying signals from 2 and/or 15 meters.

Tune In the World

Problems have plagued the Phase 3 satellites which have been beyond the control of AMSAT or the amateur radio community. Phase 3A was lost in a launch failure in 1980. Phase 3B, OSCAR 10, did not reach its full potential after launch in 1983 following a chain of events resulting from mechanical damage after deployment from the launcher. As we know all too well, there is always the possibility of problems with any satellite launch, but the new generation of rocket builders has relearned some hard lessons and are redeveloping skills of exactness and precision in their art. There is an excellent chance that Phase 3C will be delivered into its nominal orbit in nominal (i.e. excellent) operating condition. If it is, a turning point in amateur radio and in the amateur radio satellite program will have occurred.

SPECIAL EVENTS

Ham Doings Across the Country

Special Events listings will be provided by 73 magazine free of charge on a space-available basis. Announcements must be received by the first of the month, two months prior to the month in which the event takes place (by April 1, for example, for a June or later event). Please mail to Editorial Offices, 73 Magazine, WGE Center, Peterborough NH 03458. ATTN: Special Events

BARTON VT
MAY 6–7

On May 6 and 7 the Boy Scouts of America, of the Green Mountain Council of Vermont, Indian Lakes District, will hold their annual Scout Show and Camporee at The Orleans County Fairgrounds in Barton. A special event will be the operation of an Amateur Radio Station on the following frequencies (signal propagation permitting): CW 3710–3740, 7110–7140, 21110–21190, 28200–28300 kHz, and on SSB 3910–3990, 7225–7390, 21325–21425, 28300–28500 kHz, and maybe 2 meters on 146.475, .940, .880, .760. Visiting Radio Amateurs with a valid license will be operating the station. A request has gone to the FCC for a special call. For more information contact *Arnold Uttin WB1DSD.*

SPRINGFIELD IL
MAY 6–8

Special event station W9DUA will be operated on May 6–8 to honor the dedication of the Vietnam War Memorial at Oak Ridge Cemetery in Springfield. Operation will be in the General Class portion of 80m–10m (up 35 kHz) to include 10 m Novice portion from 1400Z to 2000Z. For a certificate, send QSL and a large SASE to *Sangamon Valley Radio Club, Inc., Red Cross Building, 1025 South 6th Street, Springfield IL 62703.*

BEMIDJI MN
MAY 7

The Paul Bunyan Amateur Radio Club is excited to announce their annual hamfest on May 7 at the newly constructed Moose Lodge. The action-packed day will begin at 8 AM with a pancake breakfast, then move on to Skywarn retraining, Computer & Packet Radio Demos, and a presentation of a DX Expedition by George AD0S of RF Enterprises. Exams will be given. Dealers will be present. Talk-in on 146.13/.73. Write or call *Paul Bunyan Amateur Radio Club, PO Box 524, Bemidji MN 56601; 218-751-1964.*

CEDARBURG WI
MAY 7

The Ozaukee Radio Club, Inc., will sponsor its 10th annual Cedarburg Swapfest on Saturday, May 7 from 8 AM to 1 PM at the Circle B Recreation Center, in Cedarburg (20 miles north of Milwaukee). Admission is $2 in advance or $3 at the door. Four foot tables are $3 each. Door prizes, food, and refreshments. Setup at 7 AM. For admission tickets, table reservations, maps, or more information, send a business-size SASE to *1988 ORC SWAPFEST, 101 E. Clay St., Saukville WI 53080; 414-284-3271.*

DULUTH MN
MAY 7

The Arrowhead Radio Amateur Club of the Duluth/Superior area proudly presents SWAPFEST '88 which will be held on May 7 at the First United Methodist Church (the copper-domed church) in Duluth from 10 AM to 3 PM. There will be hourly prize drawings during the day in addition to the main door prize, and a meeting of the Minnesota Repeater Council during the day. Admission is $4, with 4' tables going for $5. Talk-in will be on 146.34/.94 MHz. For more information, please contact *Ron Carlson K0BR, 5128 Wyoming Street, Duluth MN 55804; 218-525-6860.*

OWEGO NY
MAY 7

The 29th Annual Southern Tier Hamfest will be held at the Treadway Inn, in Owego. Talk-in on 146.16/.76 and 146.52. Gate admission $4. Under 14, free. Dinner and gate ticket combined is $15 in advance. ARRL VECC exams, League Forum, vendor displays, and all-day flea market. For more information or ticket orders, send SASE to *STARC, PO Box 7082, Endicott NY 13760.*

ST. PETERSBURG FL
MAY 8

SPARC, the St. Petersburg Amateur Radio Club will sponsor the Hamfest on May 8 from 8 AM to 3 PM at Lake Maggorie Park, Shelters 1 & 2, in St. Petersburg. Admission and swap tables are free. Talk-in will be on 147.06/.66. Contact *Hank Briese WA4RLV, 10804 84th Ave. N, Seminole FL 34642.*

BATAVIA NY
MAY 14

The Genesee Radio Amateurs (GRAM) will operate W2RCX on May 14 from 1300Z to 2200Z at the 18th century Holland Land Office Site to celebrate GRAM's 25th anniversary. Suggested frequencies are 3.913, 7.213, 14.313, 21.313, 28.313, and 147.225+. For QSL, send QSL and SASE to *G.R.A.M., PO Box 572, Batavia NY 14020.*

FAIRFIELD CT
MAY 14

The Greater Fairfield ARA, Inc., will operate WB1CQO during the 53rd annual Dogwood Festival, from 1300Z to 2200Z on May 14. Frequencies: 3.975, 7.235, 14.330, 21.420, and 28.310 MHz. Send a large SASE for certificate and QSL card to *FARA, PO Box 486, Southport CT 06490-0486.*

SCHENECTADY NY
MAY 14

SARA will operate K2AE from Saratoga Spa State Park on May 14 for Region II, Eastern Cluster, Boy Scouts of America, during their North-O-Ree III. Station hours will be 1300Z to 2000Z. Suggested frequencies are 14.330 and 28.360. For commemorative QSL, send QSL and SASE to *WB2STS, 2 Union St., Schenectady NY 12305.*

BIRMINGHAM AL
MAY 14–15

Plans are well under way for the BirmingHamfest '88 ARRL State Convention, May 14 and 15, at the Birmingham-Jefferson Civic Center. Exhibitor booths are $125 for both days, VIP tables are $20 per day, and flea market tables are $10 per day. All BirmingHamfest '88 booths and tables will be on the main floor of the Exhibition Hall in air-conditioned comfort. Your Exhibitor Booth reservation entitles you and your employees to free admission. Doors are open to the public on Saturday, May 14 from 9 AM to 5 PM and on Sunday, May 15 from 9 AM to 3 PM. Admission is $5 per adult. Featured are booths, flea market, forums, amateur license testing, awards, Birming-Hamfest banquet, and non-ham activities. For more information and a reservation form, contact *Mildred Cullen AA4XF, Chairman, BirmingHamfest '88, PO Box 26576, Birmingham AL 35226; 205-822-6130.*

OWENSBORO KY
MAY 14–15

The Owensboro ARC will operate the club station K4HY during their annual BBQ Festival starting 0200Z on May 14 to 0600Z on May 15. The frequency will be 7235, 28.350. For a certificate, send SASE to *Ray Tate N4EKG, 1615 East 23rd St., Owensboro KY 42303.*

UNIONTOWN PA
MAY 14–15

The Uniontown A.R.C. will operate W3PIE May 14–15 from 1700Z to 0300Z both days to commemorate the 50th anniversary of U.A.R.C./W3PIE. Suggested frequencies: lower portions of the 20–40–80 meter general phone bands, 28.333 Novice phone band, conditions permitting. 2 meter FM simplex on 146.55. Also 6/2 meter, 220/432 sideband. For certificate, send QSL and large SASE to *Uniontown A.R.C., c/o John Cermak, Box 433, Republic PA 15475.*

ATHENS OH
MAY 15

The Athens County Amateur Radio Association's 9th annual Hamfest will be on Sunday, May 15, from 8 AM to 3 PM, at the City Recreation Center. Admission is $4. Free paved outdoor flea market space adjacent to building for tailgaters. Talk-in on the club repeater is at 146.34/.94 MHz. Indoor space is only available by pre-registration. If interested, contact *Rod Holley KA8NDC, 15267 S. Canaan Rd., Athens OH 45701; 614-593-8177.* For general information, write *Carl J. Denbow KA8JXG, 63 Morris Ave., Athens OH 45701.* Licensing examinations will be offered at all levels, and those wishing to take them should mail a completed FCC Form 610 and a $4.55 check payable to ARRL/VECC to *John Cornwell NC8V, 101 Coventry Lane, Athens OH 45701.* (Walk-ins are accepted.)

CHICAGO IL
MAY 15

The Chicago Amateur Radio Club will hold its annual Mini-Hamfest on Sunday, May 15, from 9 AM to 3 PM at the North Park Village, in Chicago. Admission is $2. This will take place indoors in case of rain. Refreshments. For more information, call *George Sopocko WA9JEZ, Director of Special Events, at 312-545-3622.*

EVANSVILLE IN
MAY 15

The Tri-State Amateur Radio Society will hold its annual Hamfest at the 4-H Center on Hwy. 41 N. Evansville IN, on May 15, from 6 AM to 3 PM Admission is $3, tables are $5. All activities are held inside. Talk-in is on 147.75/.15 to 146.19/.79. For more information, call *C. Sartore N9DYE, 709 E. Virginia St., Evansville IN 47711.*

KANKAKEE IL
MAY 15

The annual Kankakee Hamfest sponsored by the Kankakee Area Radio Society will be at the Kankakee County Fairgrounds on May 15 from 8 AM to 3 PM. Free flea market tables (limited), ARRL booth, many exhibitors. Free parking and free shuttle to Kankakee Airport. Food and drinks will be available. Admission is $2.50 for advance tickets and $3 at the gate. Setup will be on May 14 from 6 PM to 8 PM and on May 15 from 6 AM to 8 AM. Talk-in on 146.34/.94. For more information, write *KARS, c/o Frank DalCanton KA9PWW, RR. 1 Box 361, Chebanse IL 60922; 815-932-6703 after 5 PM CST or 815-937-2452 before 5 PM CST.*

KNOXVILLE IL
MAY 15

The Knox County Radio Club, Inc., will hold its annual Knox County Hamfest on Sunday, May 15, at the Knox County Fairgrounds in Knoxville. There will be a large commercial display building and acres of outside flea market space available at no charge. The gates open at 7 AM and the commercial building at 8 AM. Talk-in will be on 147.00/146.40. As in the past, the Knox County Pork Producers will be serving their famous Butterfly pork chops and other goodies. VEC testing will be given near the Hamfest site. Walk-ins on first-come basis, or mail current FCC 610, copy of license, and $4.55 check payable to DeVry/VEC. For table reservations, pre-registration of testing, and advance tickets, write *Keith L. Watson WB9KHL, 119 South Cherry Street #3, Galesburg IL 61401-4527 or call 309-342-3885 evenings.*

WHITNEYVILLE PA
MAY 15

The Tioga Co. Amateur Radio Club is sponsoring its 10th annual Hamfest at the Tioga County Fairgrounds, in Whitneyille PA on May 15 from 8 AM to 4 PM. Admission is $3 at the gate or $2.50 in advance. Inside tables cost $3 each, outside flea market tables are free. There will be free parking on the grounds, VEC testing, plenty of good food and drink. Talk-in will be on 146.79 or 146.52 Simplex. For advance tickets (deadline May 1), send check or M.O. to *Bill Reilly, RD 4 Box 103, Wellsboro PA 16901.* For further information, contact *John Winkler WB3GPY, RD 2 Box 267, Wellsboro PA 16901.*

WRIGHTSTOWN PA
MAY 15

The Warminster Amateur Radio Club is sponsoring their 14th annual Hamfest at the Middletown Grange Fairgrounds in Wrightstown. Gates open at 7 AM (6 AM for vendors). Admission is $3 (XYLs and children free). Approximately 80 indoor spaces with 8' tables are available at $5 per space. Features new equipment vendors, large flea market. Talk-in on 146.52 Simplex and 147.69/.09 repeater. For information or pre-registration, contact *Frank Charlton KA3FBP, 1479 Kingsley Drive, Warminster PA 18974; 215-675-2549.*

SO. SIOUX CITY NE
MAY 20–22

The 1988 Midwest ARRL Convention will be held at SO. Sioux City Nebraska on May 20, 21, and 22. There will be seminars on DX, Packet, computers, computer repair, handi-hams, RTTY, AMTOR, FCC, ARRL General Counsel, and more. Programming will start Friday afternoon at the Marina Inn at 2 PM. A get-acquainted dinner with entertainment will be held Friday night. Activities on Saturday begin at 8 AM. There will be programs all day Saturday and Wouff Hong Initiation Saturday night. FCC examinations will be given Saturday morning. There will be a full line of exhibitors, large flea market, free 2 meter rig testing, and ladies' programs Friday afternoon and all day Saturday. District QSL Manager, MARS. The Banquet is $10 pre-registration and the convention is $6. Flea market people contact *Al Smith W0PEX, 3529 Douglas St., Sioux City IA 51104.* For convention information, contact *Dick Pitner W0FZO, 2931 Pierce St., Sioux City IA 51104.*

ABILENE TX
MAY 21

The Key City ARC is sponsoring its annual ham radio/computer swapfest on Saturday, May 21, Armed Forces Day, at the Abilene Civic Center from 8 AM to 5 PM. Doors are open from 6 PM to 11 PM on Friday, May 20 for dealer setup. Pre-registration is $5. Admission at the door is $6. Tables are $2 each. A 6:45 AM to 7:45 AM ham breakfast and 7:30 PM BBQ dinner are planned at the Abilene Inn. Plenty of parking. Also planned: a tour of Dyess AFB and the B-7 bomber, an air show, a tour of the mall of Abilene for the ladies, and a gun and knife show. For more information, call *Bill N5DOX at 915-698-4606 after noon local time.* Send pre-registrations to *KCARC, PO Box 2722, Abilene TX 79604.*

CADILLAC MI
MAY 21

A Shop & Swap sponsored by the Wexaukee ARC on May 21, from 8:30 AM to 3 PM, will be held at the Cadillac Middle School, in Cadillac. Featuring guest speaker Doug DeMaw W1FB. Swap tables, food. Talk-in 146.97 repeater. Admission is $3. Tables are $6 each. Contact: *John Craddock KX8Z at 616-797-5491* or write *Wexaukee ARC, PO Box 163, Cadillac MI 49601.*

COLORADO SPRINGS CO
MAY 21

The Pikes Peak Radio Amateur Association will hold its 1988 Swapfest on May 21 from 8:30 AM to 4 PM at the Rustic Hills Mall at Palmer Park and Academy Blvd. Free admission. Table rental is $8 in advance and $10 at the door. Commercial dealers and VEC testing. Talk-in on 146.37/.97 (courtesy of Pikes Peak FM Association). For information or reservations, contact *Al N0CMW, 303-473-1660* or write *PPRAA Swapfest, PO Box 16521, Colorado Springs CO 80935.*

DUBUQUE IA
MAY 21

The Great River ARC of Dubuque IA will operate NS0U from 1500Z until 2200Z on May 21 at the site of the annual Dubuquefest special events and message center. Operation will be in the lower 20 kHz of the 75, 40, 20, and 15 meter general bands. Station N9FVN will simultaneously operate voice in the 10 meter novice band. For QSL card, send SASE to *NS0U, 2735 Hickory Hill, Dubuque IA 52001.*

KNOXVILLE TN
MAY 21

The Radio Amateur Club of Knoxville will have their 23rd annual Hamfest/Computer Fair on May 21 at the Kerbela Temple, one week earlier than usual, and for one day only. Admission is $5. Tables are $10 each. Talk-in will be on 147.90/.30. Advance registration is required. For more information, contact *Carol Whetstone, Hamfest Chairman, 3702 Vista Lane, Knoxville TN 37921.*

SPRINGDALE AR
MAY 21

The Northwest Arkansas Amateur Radio Club will sponsor their 1988 Annual Hamfest on Saturday, May 21 at the Rodeo Center. Setup starts at 6 AM. Doors open from 8 AM to 4 PM. Featured are indoor swap tables, commercial exhibits, snack bar, ARRL/VEC testing, forums and programs, prizes for hams and ladies. Air-conditioned facility. Table reservations are $3 each. For more information or reservation, contact *Chuck Webb KA5BML or Mary Webb KA5HEV, PO Box 338, Prairie Grove AR 72753; 501-846-2847.*

PARAMUS NJ
MAY 22

The Bergen County Amateur Radio Association is sponsoring its Spring Hamfest at Bergen Community College, in Paramus NJ. Rain or shine, 8 AM to 4 PM. Buyers free, sellers at $5 per space, tailgate only. Talk-in on 146.19/.79 and .52 direct. Amateur testing, Novice through Extra, 8 AM to 11 AM. For testing information only, contact *Pete Adely K2MHP at 201-796-6622.* For general information, contact *Jim Joyce K2ZO, 286 Ridgewood Blvd., Westwood NJ 07675; 201-664-6725.*

Number 32 on your Feedback card

Dx

Hams Around the World

Photo A. The 1987 Mt. Athos DXpeditioners: (left to right) standing Alex SV2QO, George SV2UA, Nikos SV2RE. Sitting: Paul SV2TX, Lefteris SV2UF, and Nick SV2WT.

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

MT. ATHOS AT LAST!

In September 1987 six Greek amateurs staged what many DXers around the world were starting to suspect would never occur: a legitimate operation from Mt. Athos. No Greek amateur had obtained permission to operate from the Holy Mountain since Manos SV1IW was on in 1980. In the intervening years, the Greeks have carefully scrutinized every operation from the remote peninsula, and quickly cried "foul" whenever they found problems.

For example, the Greeks bitterly fought DXCC acceptance of Frank Turek DL7FT's operation as DL7FT/SV/A, and even convinced the Greek authorities to revoke Frank's reciprocal amateur license. (The DF7FT/SV/A operation was eventually accepted for DXCC credit.) Then in 1986 the Greeks stopped several Italians from mounting a "radio propagation study" from Mt. Athos. (See "Almost Athos," in the May '87 "DX" column.) Whenever the Greek amateur community objected to hams from other countries operating from Mt. Athos, DXers around the world said, "Why don't *you* operate from Athos?" After several years, DXers were beginning to despair, and started talking about deleting Mt. Athos from the DXCC list. So it was great news when the Greeks announced that they would soon be on from the Holy Mountain.

Short Notice

The operation began on the evening of Sept. 15, when Nick Georgiadis SV2RE, President of the Radio Amateur Union of Northern Greece, received word from Apollo, a 35-year-old monk at the Dochiariou monastery, that he had finally obtained entry and transmission permission from the Holy Epistasia. Nick had been negotiating for several years with Apollo, who is studying for his own amateur license, to get this coveted permission. The permit was valid for 15 days.

Nick immediately sprang into action, and started to round up amateurs who could get away for a two-week DXpedition at a moment's notice. Many local hams had already used their yearly vacation time, and others had commitments that prevented their getting away for two weeks. But within two days Nick pulled together five other amateurs and hundreds of pounds of amateur radio gear, including the following: Yaesu FT-101, FT-102, FT-980, ICOM IC-720A, IC-740, IC-745, and Kenwood TS-520. They also brought along VHF and UHF rigs and antennas, beams, and generators.

At 5 AM on Sept. 18, the group stuffed themselves and all their gear into a small rented van and headed out of Thessaloniki for the port of Ouranoupolis, where they expected to catch the ferry that serves the roadless Athos peninsula. Unfortunately, the boat operators refused to allow their cans of gasoline for the generators. The amateurs had to settle for a single 25-liter can, enough to run the generators for a single day.

Despite the short planning period and ferry problems, the group landed at the 1000-year-old monastery of Dochiariou and quickly erected their antennas: tribanders and multi-band dipoles. The monastery loaned a two-story building to the amateurs, and provided generator power during the day, allowing the group to use their linear amplifiers. The monks even provided gasoline for the DXpeditioners' own generators for contacts at night.

Quite a Haul

Using eight HF rigs, the six operators made almost 23,000 QSOs in 13 days, using their own callsigns /SY. They tried to keep three stations on the air at all times, breaking only for meals and generator maintenance. As might be expected, nearly half of their contacts were with European hams, but they managed about 7000 contacts with North American DXers, 4000 with South America, and even 1300 Oceania QSOs. The only problem was with Asia. The Japanese amateurs couldn't hear the group, as a steep mountain blocked the path to the northeast. George SV1UA and Nick ended up hauling an entire HF station and generator to the top of a 1200-meter high mountain to make about 1000 Asian QSOs. Most of the contacts were SSB, but SV2UF/SY made about 3000 CW QSOs.

Considering that none of the operators were either experienced DXpeditioners or contesters, the group did a very fine job handing out Mt. Athos contacts.

Not True

A controversy, however, tainted this operation. After the group returned to Thessaloniki, some of the DX publications printed a false rumor that the group was demanding $5 for QSL cards, which would be a violation of DXCC rules. There was no truth to the rumor, and the Greeks have never even asked for donations, although the trip entailed considerable expense to the individual operators. The local radio club SV2SV handled the QSL chores for all six operators, and no additional donation or contribution other than return postage was required.

Goodwill

The group established excellent relations with the monks at Dochiariou, and fully expect to return for another DXpedition in the near future. Perhaps they can set up a station better suited to Asian contacts, and maybe even take along some experienced CW operators and DXpeditioners to make even more contacts next time. Meanwhile Apollo continues to study for his amateur license, between his work and religious duties, which take up to 16 hours a day. Apollo has taken the CW test once, but has not yet passed it. When he does, Mt. Athos will fall way down the list of Most Wanted countries.

Photo B. The Dochiariou Monastery on the southwest side of the Mt. Athos peninsula, site of the /SY operation.

QRP

Number 33 on your Feedback card

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

DIGITAL QRP

CW

People geared to QRP tend to really go in for the small and simple construction projects. CW, therefore, is QRP's principal mode since it is the most basic. It's much simpler to build a CW-only transmitter than a SSB unit.

The main goal in QRP operation is to communicate with another person using the least amount of power. The name of the game is to be understood and not to intimidate. A much slower pace helps avoid "fills" or "repeats." Average QRP CW speeds range from 10–20 wpm.

This speed goes way up when propagation is good. Operators often use terminal units (TUs), to decode CW sent faster than 40 wpm. Most operators use a terminal unit to decode the CW for a computer. These terminal units have very narrow filters, so it doesn't take much transmitter drift for the signal to fall outside the decoder bandwidth. VFO stability, therefore, is critical for the copier using a TU.

The Ten-Tec Argosy, Argonaut 509, and 515 and Heathkit HW-9 are all very stable. The VFO on the HW-8 needs work, however, and an op may as well forget about using the HW-7.

I use a computer to decode CW sent faster than 30 wpm. My computer for the task is the Radio Shack Color Computer II. A homemade decoder picks up audio from the Argosy, decodes the signal, and displays the results on the monitor. The computer also sends my CW back to the other station. Only a simple switching transistor and reed relay is required.

Ops who can copy high speed CW by ear aren't usually much bothered by slight VFO drift.

Look for high speed CW on or about 7.032 MHz.

CCW

This is "Coherent Continuous Wave." In essence, CCW allows a higher keying rate for a given bandwidth than CW by sychronizing the transmitter and receiver. Raymond Petit W6GHM describes his experiments in September 1975 *QST*. Adrian Weiss W0RSP also did some experiments on CCW in 1977. Ade wrote about these in June and July 1977 issues of *CQ*, with astonishing results.

In addition to spectrum economy, CCW gives a 20-dB signal-to-noise improvement over a typical CW signal using standard bandwidths.

I encourage those who have experimented with CCW to share their observations with me.

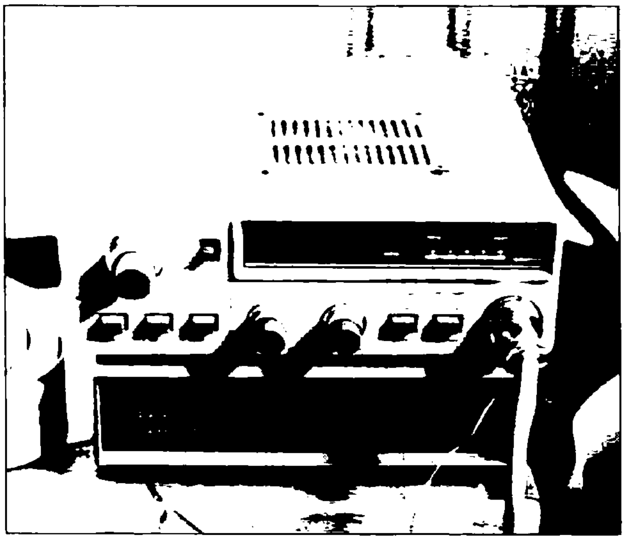


Photo A. Don't forget Packet radio for the QRP stations. Here's a unit running 24 hours a day on solar/wind power.

Photo B. It may not be much to look at, but my CW decoder allows high speed CW up to 100 wpm when connected to a computer.

RTTY

QRPers also dabble in radioteletype. Baudot code is used in RTTY. Common speeds are 60 wpm and 100 wpm—only a few stations operate on 75 wpm.

Many hams, myself included, used to use old, oily clatterers, like the Model 15 Teletype™, Model 19, and 28ASR machines to decode RTTY. These klunkers are quickly fading from the scene. There are now many computer TUs, such as my Color Color computer, which decode the Baudot code in utter silence.

The TU converts the audio tones from the receiver into a on/off voltage and routes it to the computer via the RS-232 port. The computer, with the proper software, then decodes the TU output and displays the results on the monitor. Some of the simpler phase-locked loops do a fair job decoding the audio from the radio into Baudot code, provided the bands aren't too congested.

Most QRP radios can receive RTTY. Those with a very narrow CW bandwidth don't allow enough of the RTTY signal through to let the terminal unit decode it. Again, a stable VFO is a must.

The operator needs only to shift the transmitter frequency down 170 Hz. This is called narrow shift. Wide-shift RTTY—850 Hz—is not very popular today. Direct frequency-shift keying is done by using a diode and a variable capacitor to shift the VFO down in frequency. Voltage to the diode causes it to conduct and ground the capacitor, causing the desired shift in frequency. The terminal unit/computer controls the voltage to the diode.

Have any of the readers tried to FSK the VFO of a HW-8? It looks possible on paper. The only trouble I foresee is keeping the proper 170-Hz shift on the different bands—the HW-8 has a record of moving the CW offset from band to band. Those who have dabbled with this, please send in your observations.

"Average QRP CW speeds range from 10–20 wpm."

Audio Frequency Shift Keying (AFSK) is where the the frequency of an audio signal shifts from one frequency to another. The resting tone (MARK) frequency is 2125 Hz. The frequency shifts up to the SPACE tone of 2295 Hz. AFSK is used almost entirely on frequencies above 50 MHz.

Modern HF RTTY stations use a different approach to generate FSK: they feed AFSK tones into the microphone input of an SSB transmitter. The output, while technically J2B emission, is indistinguishable from the F1B emission when properly designed and adjusted. This method is the gateway to RTTY for Argosy and Argonaut owners. I used my Argonaut on 20-meter RTTY with excellent results.

Because of the 100% duty cycle of RTTY operation, take care to keep RF power transistors within their ratings. Power supplies are called on for extra key down-time. Many 100-watt transceivers must

operate at 50–75% power for safe operation.

QRP RTTY is not at all hard. Most of the activity is on 20 meters. Remember to use LOWER sideband. Beginners should try their luck in the middle of the day on weekdays since evenings and weekends are much too crowded for low power.

"Coherent CW gives a 20-dB signal-to-noise improvement over a typical CW signal using standard bandwidths."

Calling CQ on RTTY with two watts is unrealistic. It's best to tail-end a QSO. Listen for CQs—the RTTY CQ has a sound all its own, which an operator soon learns to pick out. Leave the main tuning dial in one spot and use the RIT to tune in the RTTY station, it prevents leap-frogging all over the band.

The budding RTTYer needs only a terminal unit, computer and SSB transceiver. I don't suggest bothering with a mechanical machine. For more words of wisdom on RTTY, check out the RTTY Loop every month in *73* by Marc Leavey, MD WA3AJR. Wonder if he'll take an interest in QRP?

Amateur Teleprinting Over Radio (AMTOR)

This mode is like RTTY with one important difference. Noise and fading easily trash RTTY signals. When the terminal unit can't decode part of the Baudot code, the data is lost. This is called "taking a hit," and can ruin copy with enough errors. AMTOR has a built-in error correction scheme.

This is the key to AMTOR's success. Time diversity allows the signal more than one opportunity to reached the desired station. In other words, the same signal sent at different times will experience different fading and noise conditions. When in QSO with someone using AMTOR, if the receiving station detects a bad code element, the transmitter is turned on and asks the sending station to repeat the code. AMTOR uses two forms of time diversity in either Mode A—Automatic Repeat Request (ARQ), and Mode B—Forward Error Correction (FEC).

AMTOR, like RTTY, requires the transmitter to be on 100% of the time. AMTOR Mode A signals are usable with some transmitters at full power because of the 210–240 ms on/off timing. Also, the receive-transmit turnaround time should be less than 20 ms. This requires full QSK in a transceiver.

AMTOR requires a special terminal unit. Some of the newer all-in-one terminals will support AMTOR as well as RTTY, CW and ASCII. Not so long ago, a ham needed a special terminal unit for each mode. Now thanks to large scale ICs, several makes of multimode terminals are on the market. AEA's PK-232 is a good example. The PK-232 will decode CW, RTTY (all speeds) ASCII (all speeds) AMTOR (mode A and B) Packet, and WEFAX (weather maps).

AMTOR is also found on 20 meters, just below the RTTY subbands. Right now I don't know anyone that has used QRP and AMTOR together! Let's hear from those who have!

This has been an overlook of some of the digital communications that QRPers have at their finger tips. Take a look up and down the bands. There is a lot of new and exciting things to do. Be a mover and shaker. Spread the word that QRP operation need not be a CW-only mode.

That's it for this month. Look for a discussion next time on phone operations, including SSB and AM, OSCAR satellites, and, space permitting, VHF and UHF. Look also for a small milliwatt transmitter project to build.

The reader service cards are back. Readers should take this opportunity to express their feelings about the column. I'm always looking for input on the column, and projects to share with QRPers. Don't forget to send in good photos! ■

Number 35 on your Feedback card

CIRCUITS

Great Ideas From Our Readers

Have a quick'n'easy circuit idea? Share it and get a one year subscription or extension to *73*! Clearly mark all entries as submissions for Circuits to distinguish them from manuscripts. Send your entries to Circuits, *73 Magazine*, Peterborough, NH 03458.

ADAPTABLE MONOPHONIC OUTPUT

Here's one that the foreign manufacturers are starting to use on portable receivers, a plug for the same jack without an adaptor, for either a mono earphone or the popular stereo headsets. Audio is provided to both the tip and ring of the stereo plug. The mono plug receives audio even though it shorts the ring connection to the ground. Insertion of any plug disables the loudspeakers. A switch type stereo jack (of any size desired) must be used for this adaptable monophonic output.

Ron Johnson WA5RON
Austin, TX

LOW POWER INVERTER

This is a lower power inverter built cheaply and simply. It uses only 9 parts and turns 10 to 16 volt DC into 60 Hz. 115 volt square wave power to operate AC equipment up to 25 watts.

The LM556 (or NE556) integrated circuit is the dual version of the ubiquitous 555 timer. The first section of the timer chip is wired as an astable oscillator with R2 and C1 setting the frequency. The output is available at pin #5. The second section is wired as a phase inverter. That output is available at pin #9. Resistors R3 and R4 keep the output transistors, Q1 and Q2 from loading down the oscillator. The two transistors drive the transformer push-pull fashion. When one transistor is baised on the other is cut off.

The transformer is a 120V/18 V.C.T. unit from Radio Shack. Notice that it's connected backwards so that it steps the voltage up rather than down. Since it was designed to go the other way, it's not the most optimum for the purpose. However, it was available and cheap. If you can find an inverter transformer or feel like winding one, I'm sure that it would prove more efficient. Don't be afraid to experiment.

If you intend to drive much of a load it would be advisable to provide some sort of heat sinking for the transistors. With the parts shown, I found that the circuit will work down to about 6 volts input while still producing a 50 volt square wave output.

By changing capacitor C1, I found that everything worked nicely at frequencies up to 500 Hz. If you are operating from a supply with high effective series resistance or at much of a lead distance from the power source you may have to install a good sized (1000 microfarad or more) capacitor across the input.

The oscillator circuit U1, R1, R2, and C1 is a versatile circuit in itself. It operates from about 4 volts to 16 volts with a very stable output. Frequency is determined principally by R2 and C1 and can be figured by the formula: $f = 1.44/(R1 + 2 \times R2) \times C$. Yes, with my parts that does come out to 57.6 Hz. But that's close enough for my work. If you were going to use it as the dual-phase oscillator in a descrambler you would run it up around 3.5 kHz.

Don Cantrell ND6T
Los Molinos, CA

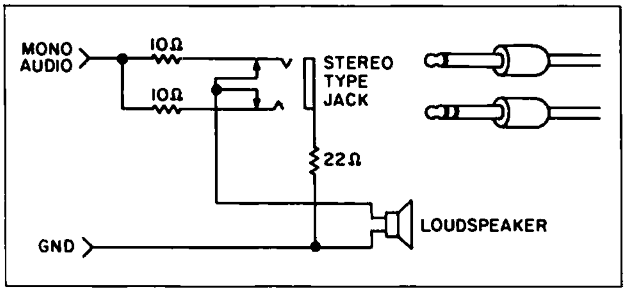


Figure 1. Adaptable monophonic output.

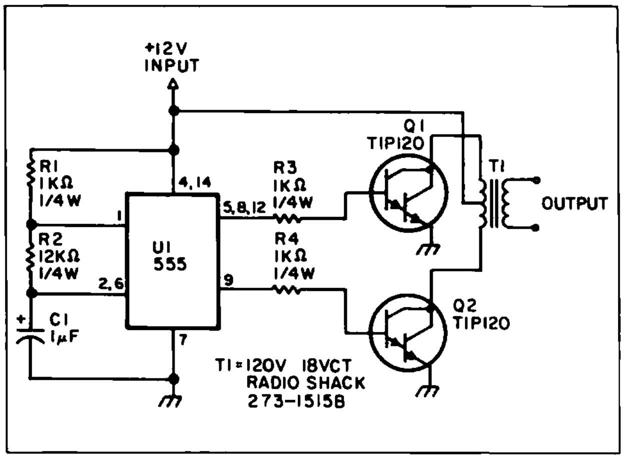


Figure 2. Low power inverter.

73 INTERNATIONAL

edited by Richard Phenix

Notes From FN42

*More information about applying for permission to operate in other countries, and about the **Universal Permit Application** will be found throughout this section this month. The word from Italy (I2MQP) is especially welcome—see box. We are aiming at the September issue to reprint the proposed application form using all the suggestions for improvement which have come in. Get your suggestions to us by July 1 at the latest!*

*Delayed apologies often only recall mistakes long forgotten, but sometimes they should be made anyway. **Taiwan** (the Republic of China) was supposed to be in the March column, but production problems too complicated to describe caused it to be dropped and added other mistakes; and ditto problems made April corrections impossible. Taiwan IS in this issue, and we share a BV QSL card in addition to show you some beautiful art. Sorry!*

May events: Constitution Day Japan—3rd; Norway—17th; Mother's Day Germany, Guatemala, USA—8th, Central African Republic—28th; Independence Day Israel—14th, Paraguay—15th, Jordan—25th; National Day Cameroon—20th, Tanzania—26th. On May 1—May Day, China, France, Germany, USSR. 2—King's Birthday, Lesotho. 5—Remembrance Day, Netherlands, Children's Day, Japan, Victoria de Pueblo, Mexico. 6—Bataan Day, Philippines. 7—Victory Day, France. 9—Liberation Day, Czechoslovakia. 13—Joan of Arc Day, France. 14—Unification Day, Liberia. 16—Discovery Day, Cayman Islands. 21—Armed Forces Day, USA, Navy Day, Chile. 22—National Heroes Day, Sri Lanka. 23—National Labor Day, Jamaica, Victoria Day, Canada, Spring Bank Holiday, Great Britain. 24—Bermuda Day (guess where). 25—Revolution Day, Argentina. 30—Memorial Day, USA. 31—National Holiday, South Africa.

Roundup

Chile (Easter Island). One hundred years ago Easter Island became a part of Chile. The Easter Island Radio Club, Gustavo Westermeier L. CE0ZIJ, president, is making available now to licensed hams and SWLs, the "100 Years of Brotherhood" award (permanent)—the CE0ZIP Award. Required: Four contacts with Easter Island radio stations OR two contacts plus contact with CE0ZIP, any band, any mode. Send US$5 or ten IRCs with a list of the stations worked (or copy of log) to the club's secretary and Award Manager, Patricia Cisternas I. CE0 GHO, PO Box 1, Easter Island, Chile. OSLs not required.

Israel. The youngest ham in Israel is Oded Sharon 4X6NB (was Novice 4X9DDD) who recently passed his Grade B (General) exam. Son of the very proud Yossi 4X1BQ (formerly 4Z4BQ), he is ten years old.

Greece. SV1IW sent in the SV1SV instructions for applying for a permit to operate. Citizens of countries having a reciprocal agreement may receive a permit good for the length of stay in the country up to one year, not renewable. Agreement countries are Canada, Cyprus, Federal Republic of Germany, France, Sweden, and the USA. The proposed Universal form appears to be more than adequate, but have the photocopy of your license notarized, and under Special Information give "the point and manner of entry of the radio equipment into Greece." Send your application to **Ministry of Communications, General Directorate of Posts and Telecommunications, Directorate of Radio Communications Control, Section III 49 L. Syngrou, Athens, Greece.**

U.S.S.R. *73* International obtained a couple of copies of the English editions of *Moscow News* in the hope of finding some items of interest to radio amateurs. The paper has an international reputation as the "flagship of the policy of *glasnost*," according to the London *Sunday Times*. "Its small Russian print of 250,000 is sold out within hours of publication, as readers rush to learn the latest revelations. . . It is no longer foreign correspondents Soviet officials fear most [but Soviet correspondents] with their new investigative edge [who have] become the greatest threat to officials who used to run their domains as personal fiefdoms." To nobody's surprise, we found no items, but how often does ham radio make the pages of any newspaper?

GREAT BRITAIN

Jeff Maynard G4EJA
32 Waldorf Heights
Hawley Hill
Camberley GU17 9JQ
England

The Radio Society of Great Britain (RSGB) this year marks its 75th anniversary. What foresight somebody had in the early pioneering days before WWI, before not just the IC and transistor, but before even the thermionic valve! The anniversary will be shared with the rest of the amateur radio world with two special stations, GB75RS and GB75HQ, which will be operating (by the time you read this) on 80 meters during midday and early evening periods (UK time). Start listening because the planned RSGB 75th Anniversary Award is bound to include contacts in its requirements! (Details when available.) As the main celebrations in July approach there will be more activity. The Department of Trade and Industry (our regulatory body) has agreed to an extension of the GB75 prefix to other stations associated with the development of amateur radio.

I have had a number of letters from readers of this column with questions about accessing the RSGB bulletin board as I've previously described it. [*See 73 International for January 1988.—Ed.*] The problems seem to hinge around transmission standards in use and may simply reflect a difference in terminology between the two sides of the Atlantic.

The RSGB system, like most in the UK, is based on the so-called Viewdata standards, defined in CCITT standard V23. There is no directly equivalent ANSI standard, so that US users will need two modems for the asymmetric speeds described below or to acquire a European modem. This is an asynchronous (i.e., character-timed) system using one start and two stop bits per character. The character code is ASCII with some control code/character combinations used which are rather simple graphics, by 1988 standards.

OPERATING PERMISSION IN ITALY

Mario Ambrosi I2MQP, Secretary General of the ARI (Associazione Radioamatori Italiani), has offered to help amateurs who are citizens of countries with a reciprocity agreement with Italy to obtain their license to operate when in his country.

Fill out the Universal Permit Application form in its proposed shape (p. 78, January issue), attach the documents called for, and mail with a fee equivalent to US$10.00 to Associazione Radioamatori Italiani, Licensing Department, Via Scarlatti 31, 20124 Milano, Italy. ARI will prepare the necessary legal document, in Italian, and will send the applicant his license to operate for three months (renewable). Complete operating information will be sent with the license (mobile not allowed on HF bands, while permitted on 2 meters and up, etc.). Upon arrival in Italy, the licensee will have to make another small payment of a tax through the post office ("only a couple of dollars," I2MQP writes).

When you submit the application, be sure to enclose a note to Mario Ambrosi expressing your appreciation. *Grazie*, I2MQP!

The most important point to note, however, is that Viewdata (also known as videotex and Prestel) uses asymmetric transmission speeds. Host (computer) to user is at 1200 baud whereas to host is at 75 baud. The most common reasons for failing to achieve a satisfactory connection are use of 1200 baud in both directions, and forgetting to accommodate the start and stop bits.

Readers interested in this may also be interested in RTTY and other data activities. Many of these are organized and/or reported on by the British Amateur Radio Teleprinter Group (BARTG), which really moves with the times. Its quarterly magazine, *Datacom* covers RTTY, data transmission, packet radio, and AMTOR. Membership is £11 (£16 per year for airmail delivery). Money orders—or IRCs for more information—to J. Beedie GW6MOK, Flynnonlas, Salem, Llandeilo, Dyfed SA19 7NP, Wales.

The British Amateur Television Club (BATC) also has a quarterly magazine, *CO-TV*., membership £6. Contact Dave Lawson G0ANO, Greenhurst, Pinewood Road, High Wycombe, Bucks HP12 4DD, England.

Having now given you addresses in England and Wales, here are a couple, for Scotland and Northern Ireland! Anyone who has worked GB2LNM might like to know that it promotes the LNM—the Loch Ness Monster. For a commemorative QSL and poster send your own QSL confirming a contact or logging, an A4 envelope, and IRCs [*Suggested translation: large envelope and 5 IRCs.—Ed.*] to GB2LNM, PO Box 20, Motterwell, Scotland . . . And GI0HOW collects old radio magazines and books for sale to raise money for the Radio Amateur Invalid and Belfast Club (RAIBC); all donations gratefully received by David Caldwell GI0HOW, 59 Connsbrook Avenue, Belfast BT4 1JW, Northern Ireland.

[*If you use any of these addresses, be sure to say that you got them from G4EJA's fine column in that excellent section, 73 International, of that super-splendid magazine,* 73 Amateur Radio, *Wayne Green Enterprises, Peterborough, NH 03458-1194, U.S.A.—Ed.*]

CEPT AGREEMENT AREAS

(CT, SV, and EA added soon.)

OL
F, FG, FH, FJ, FK, FM, FO, FP, FR, FT, FW
HB0, HB0
JW, JX
LA, LX
OE, ON
PA
3A, 3Y

THE NETHERLANDS

Joseph A. Stierhout PA0VDZ
PO Box 265
6950 AG Dieren
The Netherlands

[We welcome our new correspondent for The Netherlands, who starts us out with information on obtaining a license to operate in Holland. (Assume, unless he tells us otherwise later, that the same procedures will do for Curacao, Aruba, and Bonaire, near the South American coast, and St. Eustatius, Saba, and the Netherlands part of St. Maarten, SE of Puerto Rico). PA0VDZ tells us he is already receiving letters (see his report in the December, 1987, issue) and would appreciate a US$1 bill or an IRC with those requiring an answer. (Try to do this with all such overseas letters!)—Ed.]

For a guest license here, request an application from Staatsbedrijf der PTT, Radiocontroledienst, PO Box 570, 9700 AN, Groningen, Netherlands. [*If PA0VDZ will send us one we will work it in with our Universal Permit Application form.—Ed.*] The form should be filled in completely and signed. Send with it a certified copy of your valid license. (Note: You must be at least 16 years old.) Send Hfl.87 (by international money order is best—mark your callsign on it and also send a photocopy of it), for a one-year permit. All of this must be received by the Post headquarters at least four weeks before the starting date of the permit. [*The guilder, or florin, exchanged at two for a dollar in mid-1987.—Ed.*]

In the Netherlands we have reciprocal agreements with Finland, Great Britain, Ireland, Italy, Sweden, Botswana, Liberia, Sierra Leone, Canada, Jamaica, the U.S., Venezuela, Israel, Indonesia, Australia, and New Zealand. Even better than that, we have the CEPT license agreement (like automatic reciprocal license agreements). The Dutch Postheadquarters was one of the first to accept this agreement, which means that those with European CEPT licenses need not ask for a special license when going to another CEPT country! (See box.)

For a period of five years, March 1, 1988, until December of 1993 we get the 50-MHz band, with these conditions: Every year the permit has to be renewed; we get 50–50.450 on a non-interference basis; crossmode is permitted; CW only, 30 Watts maximum, no unmanned stations, and valid licenses are A, B, and C.

NEW ZEALAND

Des Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

Universal Permit Application. [*See also "Special Requirements," column 2, p. 90, March, 1988, 73 International, if you try to use the Universal form.—Ed.*] Here is a recap of ZL visitor-license requirements for Northern Hemisphere radio amateurs who will be planning summer holidays about now, and for use in connection with the creating of a Universal Permit Application.

Countries with reciprocal agreements with New Zealand include most of the British Commonwealth countries, the French Republic, the Netherlands, Sweden, Switzerland, and the USA. Applications may be made to any of the 18 offices of the NZ Radio Frequency Service (a newly-named office newly under the Department of Trade and Industry, now responsible for amateur radio matters), but in most cases are made to those at the main points of entry: Aukland (Telecoms Office, Federal St., Private Bag), Wellington (Anvil House, Wakefield St., PO Box 293), and Christchurch (St. Elmo Courts, Hereford St., PO Box 1800). Application forms also are available from the NZART Reciprocal Licensing Bureau-ZL3AAA, Mr. R. A. Garlick, 23 Lydia St., Greymouth, New Zealand.

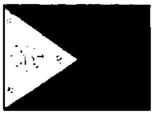
Send the application (in duplicate) along with (1) A valid copy of your operation license, which must indicate Morse speed qualification and grade of license, (2)Birth certificate or valid evidence of date of birth, and (3)Postal address in New Zealand where all correspondence may be sent. Callsigns are issued from the ZL0 series and are valid for 12 months. If application is received three weeks from the date of your arrival, the Visitor license should be ready for you to up-lift at the Frequency Service Office at your point of arrival.

NZART
"HOT SPOT CONFERENCE 88"
Friday, June 3, to June 5,
Whakatane, NZ

COMING TO NEW ZEALAND THIS SUMMER?

Plan your visit around the annual NZART Conference: plenty of technical sessions and social activities. Keynote speaker is William Orr W6SAI, prolific writer and antenna expert. Champagne Breakfast Sunday morning.
For information write me (Des Chapman ZL2VR) or the NZART Conference Committee, 233 King St., Whakatane, NZ.

A word about the "new" Frequency Service Office. On April first, last year, our always-amicable association with the NZ Post Office ended and a new one with the other NZ department began. We expect it to be amicable as well if for no other reason than that in many cases the personnel will be the same. One big change: The annual fee for the amateur license went up 40% to NZ$38.50 (about US$65), as part of a move to make the Service self-supporting.



PHILIPPINES

Leo M. Almazon WA6LOS/DU2
10098 Knight Drive
San Diego CA 92126

Hello everybody! Rumors abound here in DU-land regarding a DXpedition to Spratley Islands early this year. The Philippine Amateur Radio Association (PARA) and Amateur Radio League, Inc. (PARLINC) are the prime movers. It is said that Robin DU9RG and Ralph DU1RFA are planning the logistics and transportation—so stay tuned!

Confusion Department. Now that everybody is used to their callsigns, lo and behold, the National Telecommunications Commission in its infinite wisdom has told all amateurs, regardless of license class, that calls will revert back to using the DU prefix this year. (It used to be that prefixes showed license class: DU for A, DV for B, and DW for C.)

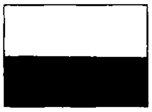
Typical PARL bull session, with Tony DU1LOG, PARL president, standing in background.

If that's not enough, district changes were made by the NTC last May. DU2s are now DU3s, part of the DU6s are now DU7s, and DU9s are now DU8s except for those who are internationally known and were allowed to keep their original prefix.

Don't try to figure it out—you'll go bananas. Come to think of it, I just worked a W1, and his QTH was Seattle, Washington, which is in W7-land!

Club Department. If you are a DX certificate-chaser, you probably are familiar with the UN-DU Award, which requires working all the member countries of the United Nations. (Submit a notarized QSL list to PARLINC headquarters, here in Metro Manila.)

PARL Inc. is a unique ham organization here in DU-land. Incorporated in 1962, prospective members are screened by a membership committee to establish their character and credibility. You must be a licensed amateur and have an interest in DX and/or state-of-the-art technologies. Most of the gatherings and eyeball QSOs are, therefore, in these subject areas. DU1RFA is the current chairman; a former airline pilot, he is an avid DXer. Meetings are every Wednesday noon in a restaurant in the Broadway Centrum shopping mall. Any DXer who would like to join should contact DU1RFA at PO Box SM159, Metro Manila 2806, Republic of the Philippines.



POLAND

Jerzy Szymczak
78–200 Bialogard
Buczka 2/3
Poland

Pieces of Information

•In January 1987 Jerzy Rutkowski SP5JR presided over a plenary session of PRRA. In addition to regular business, honors were awarded to many, including PA0LOU, president, G3FKM, secretary, LA4ND, treasurer, and the chairmen of teams of the I Region of the IARU, DF1FL and PA0QC.

•As of April reporting, the leaders [*top three reported here, only—Ed.*] of the SPDX Contest were, CW: SP6RT, SP7HT, SP2AJO; Phone: SP9VU, SP5BT, SP5EAQ; Mixed: SP7HT, SP6RT, and SP9PT.

•In May, a Presidium of PRRA Headquarters discussed preparations for Quick Telegraphy and Amateur's Radiolocation Championships, and recognition was awarded to radio stations which worked with the cities visited by Holy Father John Paul II.

•Also in May, Slupsk (Central Pomerania) was the site of the gathering of members and friends of the Radiovideography Club of PRAA to discuss new shortwave techniques, particularly in SSTV, RTTY, MSTV, FSTV, ATV, FAX, and DATA. Computer techniques in shortwave and everyday life also were discussed. The most active ham stations working RTTY are SP9BCH (60 countries confirmed), SP3CMX (54), and SP3GAX (45). On SSTV, SP2JPG had 49 countries confirmed, SP3LPM had 23, and SP3CMX had 11.

•The annual prize, "Ham of 1986," went to Ryszard Grabowski SP3CUG for his many activities in SW and USW on behalf of Leszno's District Ham Association, one of the liveliest organizations in Poland. In 1986, the number of hams in the District increased 30%, bringing the total by year's end to 90, plus 31 SWLs. Scout's clubs with most members were SP3ZAH, -ZHW, -ZFR, -ZFH, -ZSA, and -ZGI. The Club of National Defense League SP3KBW and of PRAA SP3PEI together have 27 senders.

TAIWAN

Tim S.H. Chen BV2A/BV2B
PO Box 30-547
Taipei, Taiwan, 107
Republic of China

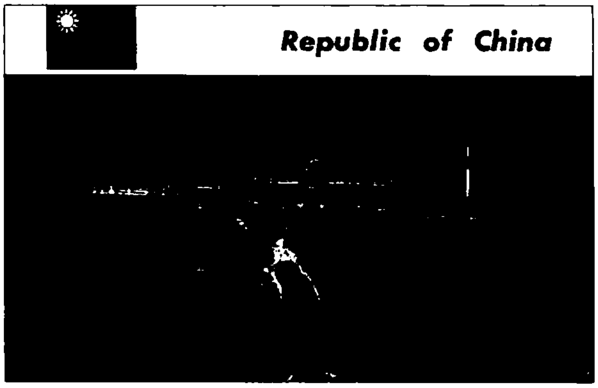
In the wake of close cooperation with the Japan Amateur Radio League and the China Radio Association, there have been six expedition groups dispatched from Japan to BVland since 1984. Each group consisted of four to ten OMs and YLs, all enthusiastic about DXing, so they gave new opportunities to people for a new DXCC award.

Beside 7, 14, 21, and 28 MHz, they have obtained special permission to operate on 3.5, 1.8, and satellite communications, which are not allowed to domestic hams. Also, the fifth JARL mission, led by JA1UT, was especially keen about 50-MHz and 29-MHz FM experimenting. The VHF transciever, IC-551, and a six-element yagi were installed at the BV2B QTH, on top of a 13-story building, much to the appreciation of all operators. Over 1,600 QSOs were made between June 5–10, 1987, including some with Korea and Guam. Considerable contacts were made on 80 and 160 meters as well, from another suburban location; 29 MHz was not interesting due to poor propagation.

Japanese hams are tireless in this field of amateur activity. A sixth expedition is due (at this writing) to have a RTTY demonstration; it is to bring a 9000E terminal unit and an RP80 Marker 2 printer as well as a CRT. A special callsign for the unit was assigned: BV0RY, for operation on 14,070–14,100, 21,070–21,100, and 28,070–28,100 alternatively. We hope that the next demonstration will be of SSTV.

In spite of the impossibility of offering visitors permits to operate, arrangements can be made for individual visiting ops to operate. *[See March issue, page 90, column 2.—Ed]* And the DX Family Foundation of Japan (DXFF) has furnished us with special QSL cards for visitors' QSOs. *[See illustration.—Ed.]* The visitor is to fill out the cards himself. Please feel free to contact me if you plan to visit our country and to give a shout on the air. Be sure to send me a photocopy of your valid license. Do NOT bring any transceiver unless you have permission of the Ministry. Additional formalities are required as well as a fee, and it takes a month or so. In fact, however, there is no need to bring in any rig. You will find here the convenience of using our facilities, for CW and SSB on 7, 14, and 28 MHz.

PARL, Inc. OT DU1RFA (Ralph)) above XYL with Alex DU1AL at right.



Continued from p. 6
human plankton and turn them into scientists.

Let's imagine the text book of 1999, only eleven years from now. I see it as a monthly magazine, making it possible for the material to be up to date in a way never even imagined for text books. In the monthly text on the fundamentals of electronics is a chapter on how alternating current was invented by Nicola Tesla—the brilliance of the idea and how it solved the problems of delivering electricity over long distances. Another chapter might discuss the foundations of computer languages and chip instruction sets. Then there'd be a column on hamming—perhaps showing a QRP rig kids could build. There'd be a column on science fair projects—maybe reviewing a new superconductivity kit from Edmund Scientific. One on school computer clubs—perhaps encouraging them to network with other school clubs via ham radio or the telephone. I'll bet we could generate a generation of science hobbyists.

Of course this could unleash a lot of new hams. With about four million kids in each grade, all exposed to the ham virus via the ham column, who knows? We might have a million hamlets running around with home-made DF gear, going on fox hunts every weekend. Other kids would be doing videos of the fun to swap with other school video clubs . . . making more hams. Young hams would be expanding our satellite communications, setting new records for miles per watt on QRP, working 400 countries with under one watt using digital communications.

Could all school courses be taught with monthly magazines? Why not? Most subjects can be turned into living experiences. History can be fascinating. Ask anyone who'd read some of the Harold Lamb paperbacks. None of that crummy names and dates memorization crapola. Just think of how many great historical movies there are that could be made available on video tape as educational assists!

And at every turn, kids could be encouraged to learn more on their own; to join groups to learn. Kids could research their own city or town history and do their own video on it or put together a book. With desktop publishing so inexpensive and simple, this tool will soon be available to many school students.

Then there's the insect world, much of which has yet to be studied in depth. Even a monthly magazine type of text would have difficulty in keeping up with the kids if they got interested in bugs. You know, in all of history, man has yet to exterminate one single species of insect? And not for having failed to try.

Math, too, can be fun. Math is a living science. Every now and then you read of a youngster who's solved some long-standing math problem. When I was in high school we had a math club where kids enjoyed the challenges of math together. A magazine would make it possible to bring the excitement of math to many more kids.

Dast we teach politics? Probably not. If the kids ever got wind of what a screwed up mess Congress is, there'd be a revolution. Not that we couldn't use one to bring that bunch to heel and get them to running the country as was originally intended instead of blowing with the breezes set up by wads of money being riffled by lobbyists and PACs. Phooey.

And if politics is off limits, imagine the howl that would go up if there was a move to start teaching about religions in school! Whoooey, what an explosion that would make! We don't want thinking when it comes to religions, we want brain washing and don't you forget it. Get those kids when they're small so we can keep up those holy wars going. Uh, oh. I've gone too far, and now you're disagreeing with me. Not logically, of course, it's just that I'm wrong somewhere there . . . right? Sure I am.

Drat, now you're not going to write me in for Veep in November. ■

Number 36 on your Feedback card

LETTERS

From The Ham Sack

Thank you for the excellent February issue of *73*. I am an avid QRPer and found something of interest in almost every article. I appreciate the monthly space you devote to QRP and hope you will continue to cover it in more detail.

I have a suggestion. Since all of Wayne's editorials sound the same, would it be possible to simply send out a copy of one editorial to all new subscribers and use the space for more QRP articles?

Charles E. Cole
Willamsport, PA

I am following "Drifting Along the Telegraph Trail" by W6CK with great interest. Dad was a telegrapher with the Atlantic Coast Line RR for 52 years, Mother for 26 years, and for 14 years I worked on the branch line, main line, relay office, ticket office, and yard office. Back then the word "ham" was a derogatory term; literal translation: "Amateur." If you called a fellow telegrapher an "amateur," you could look forward to a fist-fight when the next train came into your station.

If I could find a job as a professional telegrapher handling trains paying one-half of what I make now, I think I would leave today. Once telegraphing gets in your blood, you are hooked for life.

Bill G. Perry, Sr., Ph.D,
President
Morse Telegraph Club,
Tampa Chapter

Earlier this year, we had a little money left in our library magazine fund, so I suggested ordering *73 Amateur Radio*.

Our school has a growing amateur radio club (we were mentioned in your September issue), and I thought this would give the kids something to read besides *Mad Magazine* during their free time.

Anyway, we waited . . . and waited . . . and waited.

No *73 Amateur Radio*.

When queried, the vendor assured our librarian that he had, indeed, ordered the magazine, but that these things take time, and we should be patient, etc., etc., etc.

Finally it came: *Amateur Radio*.

Not *73 Amateur Radio*—just *Amateur Radio*! From Australia!!

It seems that there is this Australian magazine with a very similar name to our beloved publication, except it doesn't include the numbers "73" in its name.

So listen up, librarians: When you order *73 Amateur Radio*, make sure they don't leave off the *73*.

Otherwise, you'll be reading about how they do things Down Under instead of in Peterborough.

And Wayne wouldn't like that one bit!

Craig Dible KB6LAK
Beverly Hills CA

I agree with your efforts to promote progress in hams' communication techniques. I am an "old timer" first licensed as a ham at the age of 19 in 1929. Prior to that, I was involved with crystal detectors, loose couplers, and bootleg spark transmitters. But I always pushed for progress in our hobby. I don't subscribe to the philosophy of hanging on to the old way.

Harry D. Minshew W6ZOW
Saginaw TX

KD5AE's propagation program in the January 1988 issue was most interesting. His propagation program has been embellished and adapted to the Atari ST computer. ST users can obtain the program on disk from the address below for a self-addressed, stamped disk mailer plus $3 to cover incidental expenses, and a formatted 3 ½-inch disk.

Marion D. Kitchens K4GOK
Oakton VA

Your readers should know two things about the Maxcom device (reviewed in March 1988) to better understand how to properly install the unit:

1. The Maxcom device does *not* work well with a resonant length of wire. The 128′ dipole is seen resonant in the 80 meter band, and the 70′ dipole is seen resonant in the low end of the 40 meter band. By simply lengthening both dipoles a few feet, better results would have been obtained.
2. Being a grounded, non-resonant device, height above ground

is important, just as is configuration of the radiators. A height of 25' or more above ground produces superior radiation characteristics. Because the electromagnetic field generated by the Maxcom device is parallel to the radiators, lifting the ends of the dipole up towards horizontal will eliminate a major portion of RF energy from being absorbed by ground.

A new publication entitled *Maxcom Theory of Operation and General Notes* is available free for the asking.

Sonny Irons
President of Maxcom Inc.
Ft. Lauderdale, FL

Your January 1988 issue was the first I'd read in 10 years. I thought it was excellent.

I've been away from ham radio since the late 70s. No time, no money, no interest. I've kept my license, but it wasn't until I picked up your magazine that the interest rekindled.

Seems like a lot has changed. Looks like Collins, Drake, and others are no more, lots of VHF/UHF/micro activity, no more *crystals*, and something called packet radio? Naturally, I would like to see more articles for those of us less experienced or not-yet hams, but your article mix looks pretty fair—*something for everyone*. Keep up the good work!

Thanks for sparking my interest.

Mark Unland WB9VTN/5
Jefferson LA

First of all I want to congratulate you on an excellent issue of *73 Amateur Radio*. I saw your January issue #327 at the local newstand while looking for my favorite fishing mag.

The article on 100 countries in two days caught my eye. I, too, participated in the Golden Jubilee and I wanted to see how others fared. One item in particular needs clarification. Jay W6GO is to be congratulated for his accomplishments and his station. The #1 trophy from the DX Bulletin is surely very nice and he has every right to be very proud of that award. But this award was available only to the subscribers of the DX Bulletin, published by Chod Harris. I had completed my Golden Jubilee in only 44 hours 10 minutes, but did not qualify for the trophy because I was not a subscriber. Unfortunately, all DXers did not have the opportunity to compete for this trophy. There were a number of operators that were in the running. My Golden Jubilee Award, dated January 6, 1987, holds an important place on my wall, and it will continue to hold great memories of what fun DXing can be. Just share with your readers the whole story.

Richard Lyle KA2AJT
Oswego NY

We recently received a letter and magazine from Iran which I feel may be of interest to your readers as well as the amateur industry. This magazine purports to be a publication for the Iranian electronics enthusiast. Further examination revealed that they also claim to be the only "official sanctioned" magazine of its type in Iran. I doubt the Iranian government would encourage this publication to seek equipment sources in the USA unless motivated by a desire more serious than helping the local electronics enthusiast.

As you are no doubt aware, amateur equipment is often used in third world countries as a less expensive alternative to commercial (or military) gear. It seems that this letter may be a thinly disguised attempt by the Iranian government to acquire equipment suitable for use in their war against the "Great Satan."

I contacted the Dallas FBI office and have turned this material over to them. I also checked with the US Dept. of Commerce and was informed that there is a complete trade embargo against Iran in effect, with the exception of medical supplies.

Since I suspect that other companies in our industry may have received similiar letters, I hope that you can help spread the word that exportation of amateur gear to Iran is illegal, and that any correspondence of this type should be submitted to the proper authorities.

Tony Martin
Marketing Manager for Hustler

In the March '88 copy of *73 Magazine* I noticed that a minor error appears in the drawing for "Ultra-Convenient Mobile Antenna for Two Meters" (p.28).

The "ORG" wire goes from the "RLY" box to the #2 "GRN" wire. In the drawing, "ORG" is printed above the motor-drive housing on the MT-2 ANT assembly.

Ivan T. Lorenzen W4JC
Merritt Island FL

Number 38 on your Feedback card

OP ED

by Larry Ledlow, Jr. NA5E

DREAMING OF THE STARS

I am a child of the Space Race. To be sure, the Soviets launched Sputnik 1 just weeks before my arrival on this planet. In elementary school the teachers rolled televisions into the classrooms, and we all watched with wonder and amazement as more and more Americans entered space and eventually touched the surface of the Moon.

I focused my attention on the stars and planets. My future was "out there," I thought to myself. I dreamed of studying rocks from the Moon and Mars, living on a space station or in a lunar colony. The accomplishments of the Apollo and Skylab programs fueled my dreams like a gale fanning a forest fire. I burned with excitement and anticipation. Some day I would have my turn in space.

Poor Planning

Then came the Space Shuttle, a promised panacea more than a decade in the making; a project that literally killed off most other civilian space programs by siphoning their life-giving funds away. Most of our space eggs were in the Space Shuttle basket when *Challenger* disintegrated over the Atlantic Ocean two and a half years ago.

There are no more Saturn V-class heavy launch vehicles that took us to the Moon or put up Skylab. The rockets that do remain have had troubles of their own, and advanced communications, scientific, and national security payloads sit in moth-balls waiting for their turn in space . . . whenever that will come is anyone's guess.

The ambitious, optimistic planning that went into the Space Shuttle at the expense of other programs seriously failed to deliver the project's promises. A shuttle-based nirvana turned out to be a pipe dream, the smoke of which we saw 71 seconds after *Challenger*'s launch in January 1986.

A Different Approach

In *Aviation Week and Space Technology* the Soviets now advertise the availability of their *Proton* space booster for commercial launches. The Soviet space program was ahead of ours in 1957, and it's ahead now. The USSR launches more than 100 satellites per year into space. They have a large inventory of launch vehicles. Further, they have had an almost continuous manned presence in space for a decade!

They have achieved this position by consistently pursuing a number of technology fronts at relatively low levels over a long period of time.

Two lessons are very clear. First, any long range, high-technology program that depends on a single achievement has an inherent possibility of single-point failure. If the achievement does not occur, either the entire program will fail, or at least an alternative solution will cost a great deal more money and time.

Given the same money and expertise poured into the Shuttle program but applied to a number of different space projects, the Space Shuttle would have taken longer to develop. In light of the *Challenger* disaster, however, our technology base would have been broader and better able to cope with failure of any one element of the space program.

Hence, the second lesson: In the long run, many small technological successes are generally better than a single big one. The Soviets have proven that. They realized long ago that a sustained presence in space depends not on getting there "firstest with the mostest," but rather getting there and STAYING there. A broader technology base makes us better able to cope with changing conditions and goals, not to mention provides more spin-offs to improve our everyday lives.

In a very real sense I feel cheated by the short-sighted planning of the generations before me. Certainly the space science programs I wanted to participate in were dead long before I had a chance to get involved. Further, I will probably never visit space, much less live there.

Nevertheless, I have found a way to get involved "out there" by supporting amateur radio in space.

Amateur Radio in Space

Hence, hams have a role to play in our future "out there." Thank goodness for the insightful proposals and projects laid down by the founders of Project OSCAR—which began in 1959! The Radio Amateur Satellite Corporation (AMSAT) has evolved into an international, cooperative group to support continued technological achievements in space. Compared to the multi-billion dollar Shuttle or a $500 million surveillance satellite, an OSCAR seems like a small piece of the space pie. Recall, however, lesson #2 above.

AMSAT's achievements are significant in two ways. In the short term, they promote the advancement of amateur radio. In the long term, they promote a broader technology base with which to improve our future, not only in space, but also in other aspects of our lives as Earthlings.

Our future is "out there," alright. How lucky we hams are to have an opportunity to play a role in shaping the future for the world. Even if you don't use amateur satellites, take a stake in the future by supporting AMSAT and other organizations devoted to amateur radio in space.

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Welcome, Newcomers!

Digital communications—what could be easier? Just think about it.

The simplest thing to do with an electronic device is to turn it on and off, or to change a voltage from high to low or low to high. It's easy for a man or machine to differentiate between these two conditions or **logic states**. A light turned on, for example, may mean yes, while off means no; true and false; stop and go; and so on. A simple communications system like this is called **binary**, meaning to have two parts.

In digital communications, all information is expressed in terms of ones and zeros or **bits** (binary digits). A device may interpret a high voltage as a one, and a low voltage as a zero. With two choices, the information passed in such a simple system is obviously very limited. Therefore, we need to expand the system's "vocabulary." We do this by creating digital words, or **bytes**, made up of a convenient number of bits, usually 8, 16, or 32.

Let's take a look at a system that uses two bits for a digital word. The possible choices for words are 00, 01, 10, and 11. The choice of meaning for each digital word is ours alone. We can assign, say, "yes" and "no" to 11 and 00, respectively, and "probably" and "unlikely" to 10 and 01, respectively. Or suppose we wanted to express a voltage with our new vocabulary. This gives us four choices: perhaps 0, 1, 2, and 3 volts, or even 0, 15, 30, and 45 volts. Again, the choice is ours!

Now, let's get really adventurous and try to express the alphabet and numbers 0–9 with digital words. Thus, we need enough choices for all upper and lower case letters (52) and the numbers 0–9. That makes a total of 62 choices required. How large will our digital words have to be?

Every time we add a bit onto a digital word, the possible combinations increase by a factor of two. In the last example, we went from two to four choices by adding one bit. Three-bit words give us eight choices, and so on. To accommodate 62 choices, we need digital words six bits long, which actually produces 64 choices ($2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6 = 64$) in our digital vocabulary. Thus, we can have a fairly complete alphanumeric digital vocabulary with six-bit words, and even have enough room for a couple of punctuation characters.

There are many digital coding schemes for alphabets and special computer characters. The five-unit **Baudot** code is used in ordinary radioteletype (RTTY) transmissions. The seven-bit **ASCII** code provides 128 choices for characters, and includes many characters peculiar to computer operations.

How do we turn voice and other **analog** signals into bytes? Special integrated circuits known as analog-to-digital **(A/D) converters** sample a signal periodically, measure its voltage, and convert the voltage to digital words. At the receiver, a **D/A converter** carries out the reverse process.

Once we have data into bits, the next step is to send it over a radio link. Again, we normally only have to worry about two choices—ones and zeros. The simplest method would turn a carrier on for a one and off for a zero, much like Morse code transmission. This method is called on-off keying (OOK). A more reliable method of data transmission uses frequency shift keying **(FSK)** in which two different tones are used to represent ones and zeros. Phase-shift keying **(PSK)** is not as common on the ham bands as in the commercial world. This method takes a constant frequency signal and alters its phase (position in degrees) to send a bit or digital word. A shift of 180 degrees is known as biphase shift keying **(BPSK)**.

Electronic communications links are subject to noise, and to minimize or eliminate errors, many systems use some form of **error correction**. Some error correction methods simply identify that an error has occurred. **Parity** schemes add a bit onto the end of a byte. With **even parity**, the total number of ones in a word will be an even number. For example, if 11101100 is our data byte, the parity bit added to the end would be a one: 111011001, thus giving an even number of one bits in the whole word. If an **odd parity** scheme had been selected, the parity bit would be zero: 111011000.

If the parity does not match upon receipt, the operator or system may request a retransmission of the suspect word.

Mode A of **AMTOR** uses an automatic repeat request **(ARQ)** error correction scheme, while Mode B uses a forward error correction **(FEC)** method. With FEC, additional bits are added to each byte to more closely identify where in a word an error has occurred. FEC schemes can be very complex.

The beauty of digital communications lies in its fundamental simplicity and the ability to **interface** the outside world to electronic devices, computers, and transmission systems. Using these methods, we can exchange, store, and retrieve information in ways only dreamed about a decade ago. Amateur radio has entered a new age, and it's exciting to be a part of it. Come join us!

—Larry Ledlow, Jr. NA5E

Glossary for Newcomers

A/D converters—Special ICs that sample incoming waveforms (voice, video, etc) and create digital words (bytes) proportional to the voltage. D/A converters reverse the process and recreate the original waveform from the bytes.

AMTOR—AMateur Teleprinting Over Radio; a radio teletype system developed by Peter Martinez G3PLX based on the SITOR maritime system. Modes A and B of AMTOR use ARQ and FEC error correction, respectively.

Analog—A signal that varies its amplitude continuously over a given voltage range.

ASCII—American Standard Code for Information Interchange; a seven-unit teleprinter code designed primarily for computer applications.

Asynchronous—A method of signal transmission that does not use any reference to a time scale; i.e., data transmissions can occur at any time. Manual morse, voice, and manually operated teletype transmissions are asynchronous. Synchronous data is sent according to a strict time sequence so the transmitter and receiver are synchronized.

Baud rate—A measure of data transmission speed. One baud is one element or pulse, which may correspond to one or several bits each. Baud rate is NOT always equivalent to bit rate.

Baudot—A five-unit radio teletype code commonly used on the amateur bands. It does not provide for error correction.

bit—A binary digit expressed as one or zero; fundamental element of digital communications.

byte—A digital word, often made up of eight bits.

Error correction—A coding scheme that allows detection and correction of errors in a data transmission. A system may initiate an automatic repeat request, or ARQ, which tells the transmitter to repeat a block of data in which an error was detected. FEC, or forward error correction, actually builds a correction scheme into a data stream, either by adding bits to each word or by repeating each word several times to increase the chance of proper reception.

FSK—Frequency shift keying; the use of separate tones to send data bits.

Interface—The point at which data is transferred from one component to another.

modem—Modulator/demodulator; a device used to send and receive digital data.

Parity—An expression that indicates whether the number of bits in a code word is even or odd.

PSK—Phase shift keying; the use of phase changes of a constant frequency signal to send data bits. 180-degree phase shifts generate bi-phase shift keying, BPSK.

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JUNE 1988 Issue # 333

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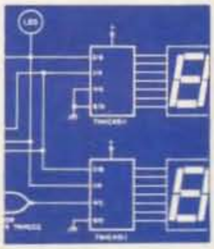

REVIEWS

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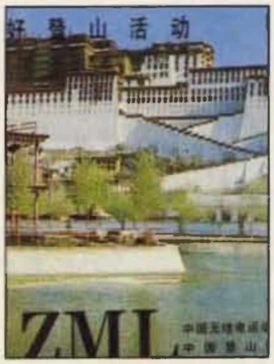

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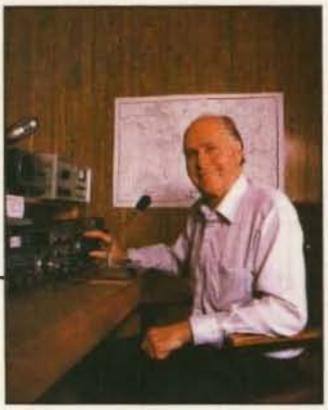

A Small World

An interesting article on cosmology in a recent *Discover* magazine mentioned a Chandra Wickramasinghe as the author of several books. Hmmm. How many Wickramasinghes can there be in the world? Could it be as common in Sri Lanka as Jones in America?

This took me back to 1959 and my flight around the world on Operation World-Wide. Lordy, that was almost 30 years ago! There I met Soma Wickramasinghe 4S7ES and her beautiful daughter Chitra during a two-day visit to Colombo, Ceylon. Soma was by far the most active ham on Ceylon. Indeed, I'd even worked her from my W2NSD home station several times.

Operation World-Wide was the brainstorm of W8PLJ, the PR director at the Pure-Pak division of Ex-Cell-O Corporation. Pure-Pak—you'll see their trade mark on almost any milk carton—was interested in doing a film of their milk container operations around the world. Since the cost of sending a film crew on such a jaunt was prohibitive, some way to cut this cost had to be found. The obvious answer was to get the government to foot the bill.

The Military Air Transport Service (MATS) provided an old C-54 left over from the Berlin Airlift operation and a crew. Pure-Pak provided the film crew. In addition to filming the milk-carton operations, the crew also would do a film on MATS for the government, thereby justifying the expense of the plane and crew. How about a ham station on the plane as it flies around the world? Great idea!

As the then-editor of *CQ*, I heard about the trip, and also found out that one of the two hams selected to go along to operate had suddenly developed a heart problem. I quickly volunteered, and the next thing I knew I was aboard the plane, leaving from McGuire Air Force Base, New Jersey, for a trip around the world.

The ham gear was the newest of new: two of five prototype Hallicrafters FPM-200 sideband solid-state transceivers, with a backup of the older Hallicrafters HT-32 and SX101 tube gear. Aboard with me were Bill Leonard W2SKE for CBS News, Hallicrafters' Bud Drobish W9QVA, Pure-Pak's W8OLJ, the film crew, the Air Force flight crew and an Air Force PR chap.

Unauspicious Start

The first stop was Newfoundland (which was still a separate country then). The two prototype rigs blew up a few hours out of New Jersey. No problem, I thought, let's fix 'em. No, said Bud, we have to ship them back to the factory to be fixed. We had no spares, no schematic or service information and all of the transistors had been soldered into the circuit boards, so repairs were out.

We didn't get that solid-state rig back until late in the trip, despite heroic efforts by Hallicrafters. The older HT-32 tube emergency rig worked fine, so Bill and I were able to talk with hams all around the world as we flew. All contacts were taped and excerpts were used on NBC's "Monitor" program.

(I even heard a contact between me and a Romanian ham on a Hallicrafters 45 rpm record a couple years later. I remember driving along Coney Island Ovenue in Brooklyn in my Porsche Speedster in which I had a Philips record player. I was listening to the Hallicrafters "Listen To The World" promotion record—and there I was! And nobody around to tell.)

The Operation World-Wide route took us in short, low altitude hops to Newfoundland, Bermuda, The Azores, Scotland, Paris, Berlin, Haderslev (Denmark), Rome, Athens, Izmir (Turkey), Alexandria (Egypt), Aden (South Yemen), Karachi, Colombo, Bangkok, Saigon (where an air raid was in progress when we arrived), Philippines, Taiwan, Okinawa, Seoul, Tokyo, Guam, Wake

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QSL OF THE MONTH

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QRX . . .

EDITED BY LARRY LEDLOW, JR. NA5E

AMSAT Phase 3C

OSCAR 13 may well be a reality by the time you read this. Prospects for an on-schedule launch of the latest Phase 3 hamsat looked great at press time. A successful launch of Ariane mission V-21 on March 11 set the stage for missions V-22 and V-23 in May. If V-22 is launched according to plan, V-23 will carry Phase 3C, METEOSAT, and PANAMSAT alofton May 26.

AMSAT will release Phase 3C for general use after a three or four week checkout period.

DXers' Delight

The peak of the current solar cycle could occur much earlier than expected, according to Dr. Patrick Mcintosh, Director of Solar Physics Research at NOAA's Space Environment Laboratory in Boulder, Colorado. No doubl many hams have observed the good band openings during the past spring. Dr. McIntosh suggests that if current trends continue, the solar peak could be the most intense ever recorded, surpassing even the legendary 1957 maximum!

Dr. Mcintosh warns that solar predictions are risky business, but he bases his predictions on three factors: the total number of sunspots and sunspot clusters; the rate of increase of 10cm band noise; and the progression of "solar crowns," areas of intense magnetic fields, towards the solar poles.

If the scientist's prediction are correct, the next solar peak could occur as earty as the end of 1988 instead of 1992.

Calling All Cars

Bill Gardner W8WG has proposed direct communications with police systems for amateur radio operators. In his recent proposal to the FCC, Mr. Gardner outlined two systems that would allow cross-service communications.

His first system would allow cross-band operation, in which both hams and police transmit on their assigned frequencies but monitor each other with "scanner receivers." The other system would establish "National Police Box Frequencies" near the edge of the ham bands (29.690, 50.005 or 52.005, 147.99, and 449.975 MHz), on which police could communicate directly with hams. The latter proposal would require a change lo Part 97 to allow police access to amateur frequencies.

Part 97 Rewrite

The FCC has proposed to reorganize Part 97, the rules governing the Amateur Radio Service. Part 97 has not been rewritten since 1951, and the Commission wishes to clarify and update the "patchwork quilt" of rules. Many technology and operational changes have occured since the last reorganization of the rules, and the FCC proposal would clarify and modernize the regulations. The actual text of this Notice of Proposed Rule Making is nearly 90 pages long. The deadline for comments on PR Docket 88-139 is August 31.

No Changes to Access Charges

The FCC has quietly scrapped its plan to increase telephone rates for computer users. According to the *Wall Street Journal*, the Commission notified members of Congress that it would no longer pursue its plan to increase computer network access charges by as much as $5.50 per hour. Computer users across the nation had opposed the proposed move, which represented a potential increase in connect charges of 100 percent or more. Information service companies like Compuserve, GEnie, Delphi, and BIX also opposed the proposal, claiming the steep access charges would have put them out of business.

The decision to drop the rate increase proposal came shortly after Rep. Edward Markey (D-Mass.), chairman of the House Telecommunications Subcommittee, said he would introduce legislation to kill the access charges. The FCC also received about 10,000 letters from computer users opposing the move, a record number of comments for a telephone issue.

The FCC will continue a separate effort to assess charges of $4.50 per hour per user to hook up private telephone networks to local systems.

Senior Ham Recruitment

The ARRL has targeted non-hams aged 50 and over for recruitment into the hobby of amateur radio. A pilot program in the Tampa/St. Petersburg, Florida, area will commence this summer. In an effort to interest more retirees in ham radio, the program will primarily recruit new hams from senior citizens' organizations. If the pilot program proves successful, a nationwide effort will follow.

Data Convention

The Radio Society of Great Britain invites participants and lecturers to the RSGB Data Convention on July 22–23. As part of their 75th anniversary celebration, the Society has organized this two day event for all hams interested in various aspects of digital data transmission and reception. The convention will be held at the Harrow School, Harrow-on-the-Hill, Middlesex. Speakers from Europe and North America will make this a truly interesting meeting, perfect for beginners to experts. For more information, contact Smudge Lundegard, Saxby, Botsom Lane, West Kingsdown, Sevenoaks, Kent TN15 6BL England, or call his office at 011-44-322-613121.

Silver Anniversary

This year is the 25th anniversary of the International Mission Radio Association, Inc. (IMRA). IMRA was founded in 1963 by 50 amateur radio operators—all of them brothers and priests in a Capuchin seminary in Hudson, New Hampshire. It has grown to include not only Catholic missionaries on overseas assignments, but laity and missionaries of all denominations. IMRA hams have offered emergency help and consolation to people whose lives have been ravaged by natural disasters. The ecumenical association's 800 ham operators regularly pass traffic to and for people in remote parts of the world.

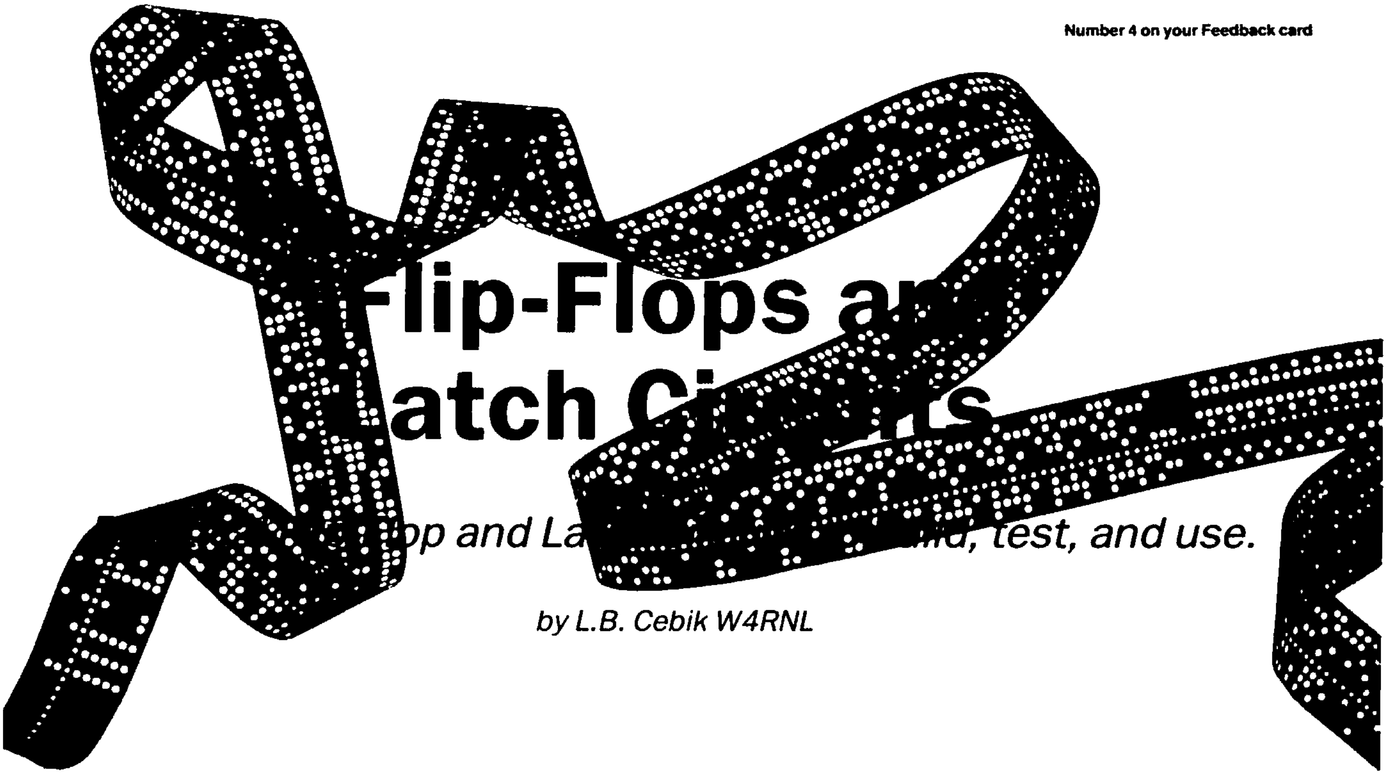
FT-727 Dual Band HT

There has been an enthusiastic response to the December 1987 *73 Magazine* product review on the Yaesu FT-727R. Those wishing more information on the 727 should call Bryan Hastings, the author of the review, at the *73* Editorial Offices, as he is often not able to answer correspondence as quickly as he would like! The phone number is (603) 525-4201, Ext. 554.

Muchas Gracias

to this month's QRX news contributors. They are *Westlink Report*, *W5YI Report*, *AMSAT Bulletin*, *Connect International*, *ARRL Letter*, *The Christian Century*, and the *Wall Street Journal*.

73 Magazine welcomes any and all news items and photos of interest to hams. Please send them to the magazine at WGE Center, Peterborough NH 03458-1194. Attn: QRX.



Flip-Flops and Latch Circuits

…op and La… …, test, and use.

by L.B. Cebik W4RNL

Why Know Flip-Flops and Latches?

The flip-flop is one of the most versatile chips in the entire digital IC family. "Flip-flop" is actually the name of a circuit configured in many different ways; for example, with transistors or gate chips. A more formal name for the circuit is the bi-stable multivibrator. The more informal name reflects the fact that modern ICs add special features to the basic circuit to make it even more flexible. It's possible to clock in data, preset the outputs, clear the outputs, and feed the output back to the input. These features allow the creation of many useful circuits.

There are many good sources of information on the basic theory of the flip-flop in its many forms. Lancaster's *Cookbooks* devote entire chapters to fundamental flip-flop operation. Times have changed since the publication of this information. Digital families now have hundreds of members, many of which perform special functions that, at one time, had to be configured with several gate and flip-flop chips. In today's world, it's necessary to know what functions basic flip-flops perform best and how to use that knowledge in selecting more complex chips tailored to special needs. Therefore, there will be little theory here.

This discussion will mainly look at practical circuits and see how hams can apply them to their designs. Some of the jobs basic flip-flops still do best are switching, dividing by two, making controllable shift registers, and controlling circuit functions. This is not all the work fit for flip-flops, but it provides an appreciation of their versatility.

Related to the flip-flop in most data-book listings is the latch. Although somewhat different in internal circuitry and function, the latch also holds a piece of data and controls circuit functions. This presentation will com-

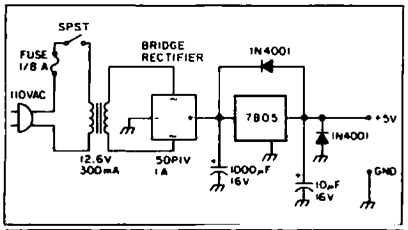


Figure 1. 5-volt test power supply.

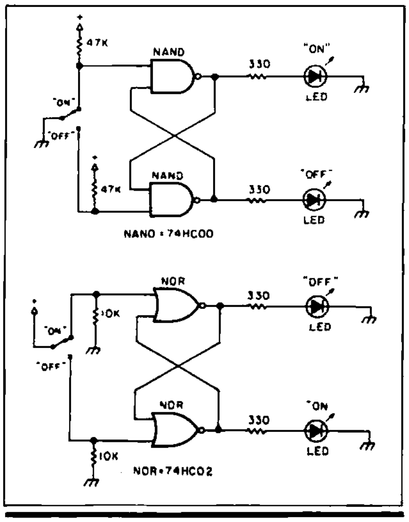


Figure 2. NAND and NOR flip-flop switches.

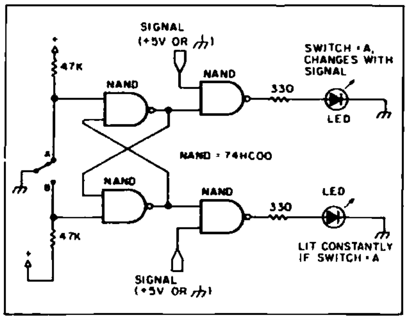


Figure 3. NAND flip-flop controlling pass/block gates.

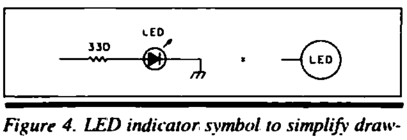


Figure 4. LED indicator symbol to simplify drawings.

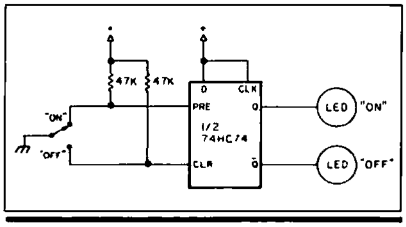


Figure 5. Flop-flop chip used as a debounced switch.

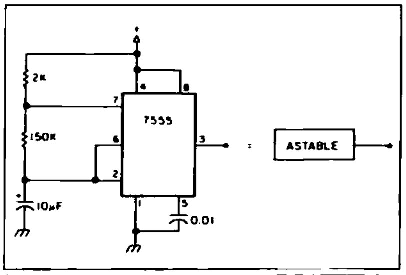


Figure 6. A handy source of slow pulses.

pare and contrast latches and flip-flops, and show which differences will make ham circuits work better.

Materials

First is an experimenter's board or IC breadboard for the tests. Second is a power supply. The simple 5-volt supply in Figure 1 will handle all the experiments. Be sure to use a heat sink on the 7805 regulator. Also, do not forget the fuse. The power supply and experimenter board make up a useful package both for this exercise and for future experiments.

Third, a small collection of parts. Four or five 74HC74 D-type flip-flops, a couple of 74HCOO NAND gates, a pair of 74C02 NOR gates, a 74HC75 latch, a few LEDs, a handful of 330Ω, 10kΩ, and 47kΩ resistors, plus some specific parts for some handy test modules will fill the bill. No soldering will go on here, since these parts will later go into real projects.

> ***"In today's world, it's necessary to know what functions basic flip-flops perform best and how to use that knowledge in selecting more complex chips tailored to special needs."***

The Basic Flip-flop

Figure 2 shows a pair of basic flip-flop circuits made from gates. As the two diagrams show, either a pair of NANDs or a pair of NORs will work fine. Because the output of one gate feeds back to an input of the other, briefly changing the rest state of one of the control lines can switch and latch the output state. Not only does the output change when the input changes, it stays that way after releasing the switch or whatever pulse system used to affect the control inputs.

This fact is useful, because it gives a debounced switch, one that does not show any of the make-break problems of mechanical switches. Figure 2 shows how to use the flip-flop with mechanical switches at the input. The rotary or toggle switch switch should be a break-before-make type, since during the brief period that the switch is disconnected between positions, the flip-flop output will remain as it was left. It changes to its new state with the first touch of the switch contacts, and it stays that way, no matter how many times the switch contacts make and break before settling into their final position. The resistors on the control input lines hold the control inputs HI or LO (as needed) when the switch is not reversing them.

The Xs in the input lines show the points where it's possible to remove the mechanical switch and resistors in order to feed control signals directly to the inputs. This mode of operation requires signals always present at the inputs as either HIs or LOs. If a no-signal condition is desired (e.g., following a tri-state buffer) then one should keep the pull-up or hold-down resistors on the control input lines.

The two basic flip-flops in Figure 2 use 74HCOO and 74HCO2 gates. It's possible to substitute regular CMOS NAND and NOR gates (with changes of pin numbers) and use the same value resistors. If using 7400-series TTL ICs or 74LSOO-series low-power TTL ICs, check the manuals for proper pull-up and hold-down resistors. However, since the 74HCOO-series combines the best features of both the 4000-series CMOS ICs (except for the wide range of operating voltages) and the 74LSOO-series, I will use them throughout these experiments.

Versatility

Notice that the flip-flop has two outputs. They are conventionally called Q and −Q, since one is always the reverse of the other. When changing a control input, both outputs change together. This feature is very useful, because some complex circuits may require a HI in one place and a LO in another, with both conditions reversed for the off, inactive, or opposite condition. Figure 3 shows an example, using gates as passing/blocking elements for pulses. When gate I passes, gate 2 blocks, and vice versa. The output from the flip-flop tells the gates whether to pass or block. Note that it's possible to use a single gate IC with four gates per chip to create this entire circuit. When there are unused gates and the builder needs only a control switch, the simple flip-flop is often the best way to go.

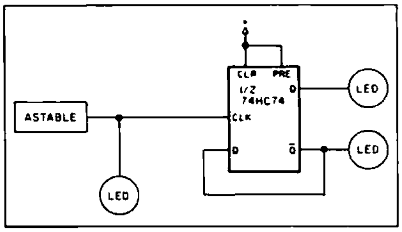


Figure 7. Basic divide-by-2 flip-flop circuit.

In Figures 2 and 3, LEDs with series 330Ω resistors are indicators. Figure 4 shows how the remaining diagrams will represent the LED indicator. By using the simplified symbol, the reader can keep his attention focused on the important aspects of the test circuit. As a convention, the LED will indicate a HI condition. When the LED is off, a LO is present. As I proceed, I shall represent some other useful test circuits in the same way.

One can do the same basic switching job of Figure 4 by using one of the designated flip-flop ICs, such as the 74HC74 D-type flip-flop shown in Figure 5. For the moment, ignore the Data and Clock inputs by tying them to the positive supply voltage line. For this chip, the Preset and Clear inputs are the control lines that correspond to those in the gate flip-flop circuit. Then take the Preset input LO to make Q HI and −Q LO, and take the Clear

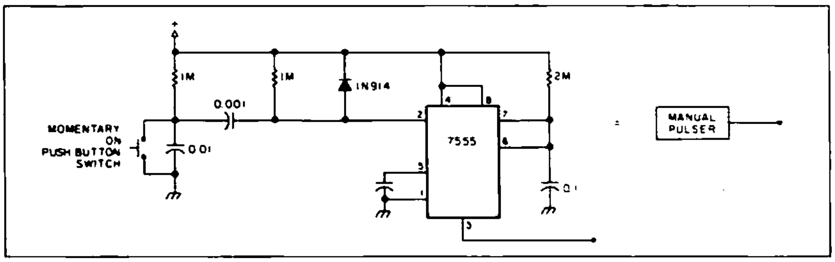


Figure 8. A handy manual pulser (pulse duration ⅓ second).

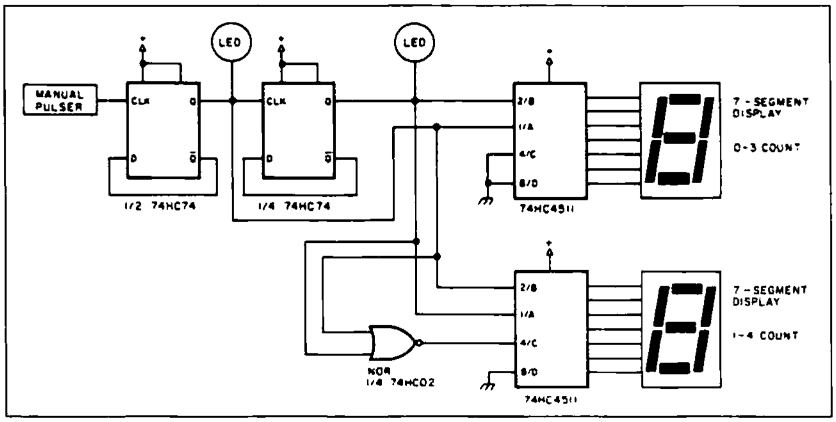


Figure 9. A flip-flop binary counter-controller-indicator.

line LO to make Q LO and −Q HI. Since the 74HC74 has two flip-flops per chip, only half a chip is used, just as the gate version of the switch.

There are other kinds of flip-flop chips, such as the J-K models, and there are multiple flip-flop chips with many individual circuits, but restricted control features. Rather than entering the confusion of trying to track many different kinds of ICs, I'll stick with the 74HC74 so the reader can try to master most of its capabilities. Then the reader can apply the lessons learned to almost any of the other variations.

Flip-flops as Dividers

The D-type flip-flop provides additional circuitry for clocking data into the chip. A pulse source will help make use of this circuitry in these experiments. The astable circuit in Figure 6 uses a 7555 to produce pulses with about a 1 second on-time and a 1 second off-time. The 74HC00-series chips here can handle frequencies well above 10 MHz, but this slow pulse rate allows the reader to see the circuit operation more clearly.

To use the Data and Clock inputs of the 74HC74, hold the Preset and Clear lines HI. Next, we must place the data (a HI or a LO) at the Data input. Finally, place a LO-to-HI transition on the Clock input line. The first step is normally done when wiring the circuit, as in Figure 7. Then, whatever the state of the Data line, when the clock goes from LO to HI, the D-state will appear at the Q output and its opposite will appear at the −Q output.

However, Figure 7 shows the −Q output wired back to the D input. The circuit also shows the 7555 astable circuit feeding pulses to the Clock input. Take a close look.

Assume that Q is LO and −Q is HI. This means that D is also HI. When the Clock pulse goes from LO to HI, the HI on D appears at Q. Then −Q goes LO, which means that D also goes LO. But nothing will happen to D's LO until the next Clock pulse changes from LO to HI. With this second pulse, Q goes LO and −Q goes HI, feeding D a HI. This cycle continues. Note that the Q and −Q outputs make one complete pulse for every two pulses from the 7555. The circuit divides the frequency of the astable by 2.

The divide-by-two circuit is very useful. Sometimes an experimenter needs both the original frequency and another frequency half as fast. In many applications, the tester can start the astable at twice the desired frequency, and use the divider circuit to bring it to just the desired value. Remember that in the 7555 circuit, the HI and LO durations are not exactly equal. If equal on and off times are important (e.g., in coded systems), the divider circuit guarantees equality.

Simple Counter

A builder can make a simple binary counter and controller by stringing together divider circuits. To operate this circuit, let's make a debounced manual pulser. Figure 8 shows a good circuit, again using the 7555. The input resistors and capacitors to the trigger pin simply guarantee that there is one pulse per finger press on the switch. I use some extra keyboard switches pulled from a defunct project for this work. Keyboard switches are among the best press-release switches available. Incidentally, I keep two or three prewired perfboard versions of both the pulse circuit and the astable circuit close at hand and just plug connecting wires into the breadboard. In the long run, that saves a lot of time.

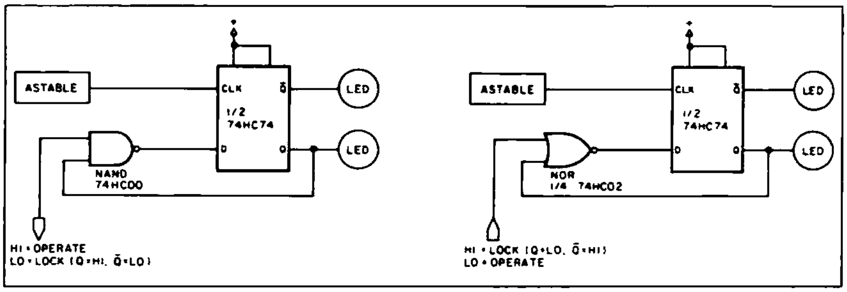


Figure 10. Controlled dividers using NAND and NOR control gates.

Figure 9 shows an example of a simple binary counter using two flip-flops in series. This starts with a debounced pulser. Note that there are four LEDs connected to some gates as a substitute for a controlled circuit. There are up to four pass/block gates or any other type of circuits among which to switch. When pressing the button, the next LED lights—or the next circuit becomes operative—with all the others off.

At the same time, a binary number between 0 and 3 is created, using the Q outputs of the two flip-flops. The experimenter can place these two outputs on the 1 and 2 inputs of a BCD driver chip that feeds a 7-segment display.

Now wire the 4 and 8 inputs low. The result is a display that reads 0-1-2-3 when pressing the button, indicating the number of the activated circuit. Figure 9 also shows some optional additional circuitry to allow the 7-segment display to read from 1 through 4. The NOR gate simply converts the flip-flop LO-LO = 0 into a HI to trigger the 4 digit.

This basic circuit is useful to about one more place for counting up to eight and controlling one of eight circuits manually. However, beyond eight, there are many more flexible binary and BCD counters, as well as programmable divide-by-N counters. There are decade counters (74HC160), dual decade counters (74HC390), 4-bit binary counters (74HC161), dual 4-bit binary counters (74HC393), divide-by-10 counters (74HC4017), up/down counters (74HC191), and 14-bit counters with a built in oscillator (74HC4060). They are all based on flip-flops, but that circuitry is buried inside the chip. One needs only to master the input and output connections and any special rules of operation to use them.

For example, some counters count on a LO-to-HI transition of the Clock input, others on the HI-to-LO transition. Most have Reset lines that instantly return the count to zero, but some need a HI to do the job, and others need a LO. When checking out these counters in data books, be sure to read all the rules.

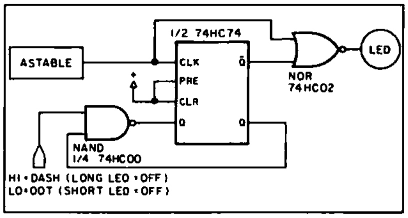


Figure 11. A controlled-flip-flop divider for making Morse dashes from dots.

Controlled Dividers

So far, the divide function of D-type flip-flops have been used in an uncontrolled manner, dividing all the time. However, by adding a gate, it's possible to control just when the circuit divides. Figure 10 shows two controlled dividers, using NAND and NOR gates. Which one the experimenter uses depends upon the gates available in his circuit and whether he wants to control the process with a HI or a LO. Since the gate will reverse the level of the feedback signal, he feeds the Q output to the gate (instead of the −Q output).

Figure 11 shows an application of the controlled divider circuit to make Morse code dashes from dot pulses. When the NAND gate input is LO, its output to the D terminal is HI. The clock pulse will make Q HI and −Q LO. Since −Q goes to the NOR gate, the LO permits the gate to pass (inverted) whatever comes in the other input line. In this case, what passes are dot pulses.

When the NAND gate input is HI, its output to the D input will be the inverted Q output. If Q is HI, D is LO. The next clock pulse will make Q LO and −Q HI (with the D input seeing a HI). The −Q HI hits the NOR input and holds its output LO during both the HI and the LO part of the original clock pulse.

Now, with the start of the next clock pulse, the HI D input transfers to Q, with −Q going LO. Thus, one gate of the NOR is LO, allowing the dot pulse to pass as a dot. The result is a NOR output LO three times as long as a dot LO, while the space time (HI) is the same length as usual. By summing the dot pulse and the divider pulse, it makes perfect dashes.

Combine Figure 9 and Figure 10 elements to create a divider-controller-counter that operates only under certain conditions fed to a divider-controller gate. The possibilites are endless!

Next time: Shift register circuits.

Opening Doors for Kids

A unique classroom program in NYC

by Carole Perry WB2MGP

Photo A. Carole Perry WB2MGP and her QSL.

Seven years ago when I began "Introduction to Amateur Radio" as a course at Intermediate School 72 in Staten Island, New York, I couldn't have known the extraordinary success we would have with the children. There was no way of anticipating the tremendous parental and community support this course would inspire.

Since its inception, over 4500 students have come through this unique program. I teach ten classes each term with approximately 35 youngsters per class in sixth, seventh, and eighth grades. A large percentage of them have received licenses; all of them have left with a better feeling about themselves, having learned new skills and having been exposed to an incredible hobby. Most children going through the school system today do not have the opportunities that are available to the children in this program. In fact, when the course is over, a whole new world opens up to the youngsters.

Not a Grind

Instead of "grinding out" Novices and ramming technical jargon and formulas down the children's throats, I use ham radio to motivate the students in all other areas of the school's curriculum. Probably no other hobby can offer the multiplicity of facets to use as motivational tools in a classroom. The philosophy is to have fun and to see that having fun can mean using the radio in an intelligent and responsible manner to learn more about the rest of the world.

I always encourage the youngsters to study at home with a parent or with a sibling. Parents love the idea of sharing something new and interesting like ham radio with their children. They are always very supportive of our program.

"My special thanks to Mrs. Carole Perry for creating a program that bought my son and me closer together. Studying and being tested together was fun, and we're now both in the fantastic hobby of ham radio," wrote Mrs. Marilyn Aronson KA2SXC, mother of Michael Aronson KA2RNP.

Remarkable Progress

What is the most wonderful thing about a program like this? The course has something for everyone. Non-English speaking children have made remarkable progress in learning to speak English because of the skills involved for the telegraph key. After all, CW is a new language for everyone. So everyone in the class starts out on equal footing.

Bright students need to be challenged with exciting and stimulating material. Most of them are overstimulated by the various media to which they are exposed in conventional classroom studies, and they are underworked. Most do not want to work hard to be successful in school. Ham radio offers endless possibilities for the good student. In an age where computers are becoming a household item, these kids are delighted to learn about packet radio. I am quick to point out that hams have obvious advantages for career choices in electronics, computers or communications.

Even more "reluctant learners" recognize that they have a chance to be successful at something for the first time in their school careers. They learn to be responsible and careful in handling the equipment. They may discover skills they have in anything from soldering to designing a creative QSL card. It's my job to keep the motivation high and to make sure that every child succeeds at something.

Even though we have a Novice license pass rate of 75 to 80%, it's not the main objective of the course. My philosophy is to show the students a new and exciting way to learn things in school and to be aware of this most unusual hobby. Who knows? Someday these youngsters may be married to ham radio operators (heaven knows that requires a lot of understanding) or that they might be voting on antenna ordinances. It's important that they learn about amateur radio in a positive and responsible manner.

Photo B. A few hams from Rocci Laurie School.

Helping Others

One of the units I teach in the program deals with "Handi-Hams." This is a great opportunity for a teacher to expose the children to some of the spirit and determination hams are known best for. Joe Schwartz K2VGV is a local operator who has been very supportive of our program. Joe is a double

amputee who spends a good deal of his time in the hospital. That hasn't stopped him from making a real impact on the kids. He has invited the children from my classes to his home so he can spend time with them, one on one, showing them radio procedures. Parents go along with their children and are exposed to the wonders of ham radio as well. As anyone will agree, the children are learning more than just radio when they sit with Joe. Handi-Hams working with youngsters reflect all that is the true spirit of our hobby.

One thing I enjoy most about what I do is observing what transpires when my retired ham radio friends come to the classroom to work with the youngsters. They enrich us all by sharing their experiences and expertise with us. The children benefit manifold from these contacts, and so do the retired hams. These are human values being reenforced along with radio skills. How do you beat the winning combination of youth and curiosity coupled with the wisdom and experience of age? I've spoken with many chapters of the New York, Long Island, and New Jersey Quarter Century Wireless Association, and they have always expressed a willingness to help out with my kids.

Photo C. A variety of QSLs made by the students.

The Next Step

About a year or so ago, I realized we had a real problem of providing a "next step" for the children who had their licenses but were no longer in my program. We lose too many Novices once they get out of "my nagging range." Ham radio is a hobby that thrives on human contact. There were just too many of these Novices out there for me to handle properly. So we began a night class at our school, taught by volunteers from the local radio clubs. It was available to parents and members of the community as well as to the children for upgrading purposes. Because of the night classes and the devotion of many Staten Island ham friends, we've managed to get about a 7-10% upgrading average.

This past spring we planned a huge reunion at a local college. For one whole day, there were exhibits and demonstrations in amateur radio for all ex-students and anyone else who's interested in learning about our hobby. We also provided services for license renewal in an attempt to get former students back into the fold.

Special Contact

On August 1, 1985, amateur radio gave me a chance to help hundreds of children and community members to participate in a once-in-a-lifetime opportunity: to contact an astronaut. For many months the children learned about space travel, NASA's objectives with space shuttles, and radio communications in space. Hundreds of hams from Staten Island and New Jersey donated endless hours of their time and expertise to help make the contact a success. The local TV and radio stations were there at our school to root us on and to record the event for the news that night. The highlight of the day came when we received astroham Tony England's (W0ORE's) picture on our school's TV monitor via slow scan TV. The entire event is still talked about with pride in our school and community.

Another nice project we've recently gotten involved in is to check into a Florida/NY net early in the morning on 20 meters. The children love identifying the "regulars" by their voices and then by their call signs. The youngsters have invited the hams from the Carolinas and Florida to visit our school when they come up North. We're all looking forward to that. We've already been fortunate enough to have a ham from Italy come to visit us in our classroom. When Dr. Giorgio Beretta I2VXJ spent the day with us, he provided us with some first hand insights into ham radio in Italy.

Our ham radio newsletter, *The Ragchewer*, gives each child a chance to contribute something and to get to see their names in print. The children do all the artwork, articles, interviews, and publishing themselves. The entire school enjoys the publication.

The next edition of *The Ragchewer* will include an article about Brother Joe AC1U from St. Anthony's in Elizabeth, New Jersey. He has provided my class with a videocassette about the IMRA (International Missionary Radio Association) and has helped to introduce yet another aspect of amateur radio into our classroom.

Photo D. A touch of class.

New Horizons

By emphasizing the human side of our hobby, I hope to provide the children with the key they will need to open the door into the most exciting and diversified hobby and service that exists today. ■

73 Review *by Larry Antonuk WB9RRT*

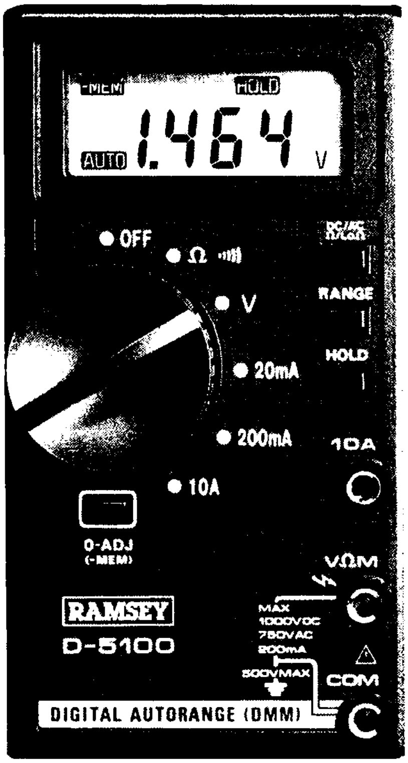
Ramsey D-5100 Digital Autoranging Multimeter

Ramsey Electronics
2575 Baird Road
Penfield, NY 14526
Price: $50

The VOM is the one piece of equipment that is absolutely mandatory for anyone wishing to do any type of troubleshooting. In the past, hobbyists on a budget wound up with one of the analog Radio Shack models—usable. not highly accurate, able to survive maybe one or two drops before becoming totally unreliable—and they got by. If they actually made some cash fixing something, they might get all the way to the classic Simpson 260 - accurate, tough as nails, impossible to read. Any type of digital meter was completely out of the question.

Things are a little easier these days. For a mere fifty bucks, today's tech can buy a digital meter with accuracy that makes most analog meters look shabby, with autoranging thrown in! The Ramsey D-5100 comes in a compact package. Measuring 2.5" x 1.0" x 5.0", the meter will easily fit into the messiest toolbox. The case is made of high-impact plastic (able to survive plenty of dropping!). A rotary switch selects the function and four pushbuttons determine secondary modes (AC/DC, Range, Hold, Memory). The multimeter comes with those nice rubber-like test leads, with safety banana plugs.

The meter boasts the usual specs: 1000 VDC, 500 VAC, 0–200mA or 0–10A, and 0–2MΩ. A continuity annunciator chirps when reading less than 20 Ωs and is also used to indicate range changes, overrange, etc. The autoranging feature is not lightning fast, but most readings settled down in well under a second. If the autoranging feature is not desired, a tap on the RANGE button locks the current range or allows the user to step up through the ranges. The MEM button allows the operator to subtract the current reading from subsequent readings. The HOLD button simply controls when making low resistance readings - useful mainly as a "zero" control when making low resistance readings. The HOLD button simply freezes the display; it doesn't let the operator hook the meter up, leave the area, and come back to see the highest voltage, etc. displayed. (A use for this feature has yet to come to mind.) The D-5100 will test semiconductor junctions, and has a low power ohms function for in-circuit testing.



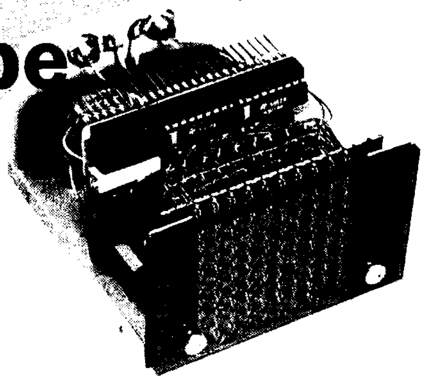
The only weak point in this product is the instruction manual. While fairly complete, the broken English is sometimes difficult to understand. Techs new to digital meters will find a series of examples in the back of the manual that will walk them through any possible use of the instrument.

Thanks to Ramsey Electronics, what used to cost as much as a new car now costs as much as dinner for two. Keep the wife home tonight and put one of these in your toolbox. I'm sure she'll understand.

Digital X-Y Oscilloscope Display

A classy, cost-effective tuning indicator.

by Dean R. Becker WA9TYU



X-Y oscilloscopes are very useful as tuning displays for RTTY demodulators and other applications. There have been numerous articles written describing how to make X-Y displays using conventional cathode ray tubes (CRTs). These make excellent tuning indicators, but the size of a CRT and its support circuitry may be larger than the demodulator it complements! The digital scope described here is small, simple, and works great. Power consumption is very low. This unit is powered by a 9V, 100mA plug-in power supply.

The display is created by 100 LEDs arranged in a 10 × 10 square. The LEDs used here have 0.1 inch lead spacing and are mounted 0.1 inches apart from each other. This works very well with standard 0.1 inch spacing circuit board material, such as the Radio Shack 276-158 with soldering ring holes. Any LED may be used, but small LEDs with 0.1 inch lead spacing will work best. The LEDs are wired together in a matrix. The anodes are tied together in each row, and the cathodes are tied together in each column.

The LED display is driven by two LM3914 dot/bar display drivers (Radio Shack 276-1707). These chips normally drive an LED bar graph display. They have everything needed to take in an audio signal and form a linearly proportional output capable of driving LEDs directly. In the X-Y display, one LM3914 is used to drive the LED columns directly. This provides the current sink for the LEDs. The other LM3914 controls ten PNP transistors that source current to the LEDs via the rows. Most any general purpose PNP transistor will do. By using this arrangement only one LED will be on at a time.

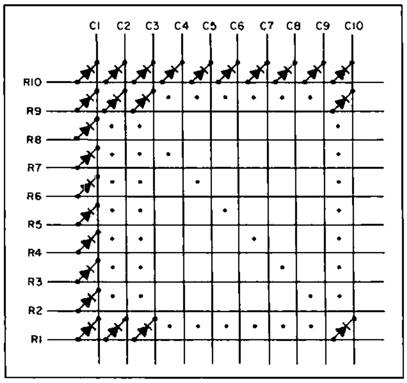


Figure 2. 100 LED Array.

The X and Y inputs are referenced to ground, and each has an amplitude adjustment that scales the input signal to match the display boundaries. An input signal of 1.2 volts can drive the display to full scale. The offset adjustment allows the display to have X,Y = 0,0 in the center, thereby providing a four quadrant display. To use the digital X-Y scope as a RTTY tuning indicator, connect the mark and space filter outputs from the demodulator to the X and Y inputs of the scope.

The display provided by the X-Y digital scope is, of course, not as smooth as that provided by a CRT.

Construction

Two 2.2 × 3-inch circuit boards are used in the construction of the scope. The LED display board mounts in front with the second board mounted about two inches behind. The LEDs should have their leads trimmed so the anodes are ½ inch long and the cathodes are one inch long. Insert and solder the first row of LEDs at the bottom of the board. (Note: the Radio Shack 277-1008 Audio Amp/Speaker has a grid of holes in front that are spaced 0.2 inches apart. This makes a great holder for the LEDs as they are soldered in.)

Now take a length of bare 26 gauge wire and weave it from one LED anode to the next, near the end of the lead. Solder the wire to each anode of the first row. Next insert and solder the next row of LEDs. Using another length of bare 26 gauge wire, solder it to each anode of the second row. Continue this operation for each row until all LEDs are mounted. Next use another length of bare wire to connect the cathodes of the first column near the end of the lead. Do this for each column. When this step is complete connect a short length of wire to each row and each column to be connected to the other circuit board. There should be ten column wires and ten row wires. The column and row bare wires should not contact each other.

Wiring of the second board can be wire wrap or point-to-point soldering. Mount the LM3914s, transistors, resistors, and pots. Connect all intra-board wiring first. Next connect the display wires to the board. Connect the X and Y signal input to phono jacks. And connect the incoming DC power through an on-off toggle switch to the board.

The circuitry can be tested by connecting two oscillators, radio outputs, or RTTY scope outputs as signal sources. Calibrate the offset so that with no signal input, the LEDs in the center of the display light. Provide an input on the X channel only. This should produce a horizontal line in the middle of the display. A similar input to the Y should produce a vertical line in the middle of the display. Connection to the scope outputs of a RTTY demodulator should produce the familiar cross hair pattern in the presence of a RTTY signal.

This design can be modified to include more LM3914s chained to the existing ones. This would allow a larger number of LEDs to in the display if desired. Different color LEDs can also be used to show limits or just to make it more interesting. The LEDs used may be point-source or diffused. This version used point source LEDs, which provide a sharp display. ■

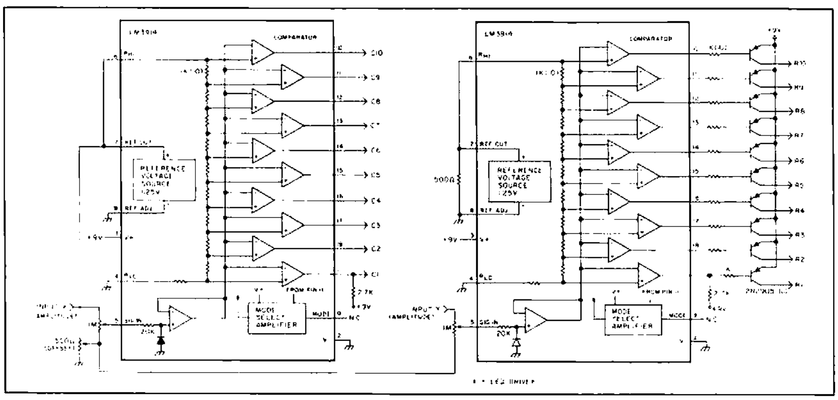
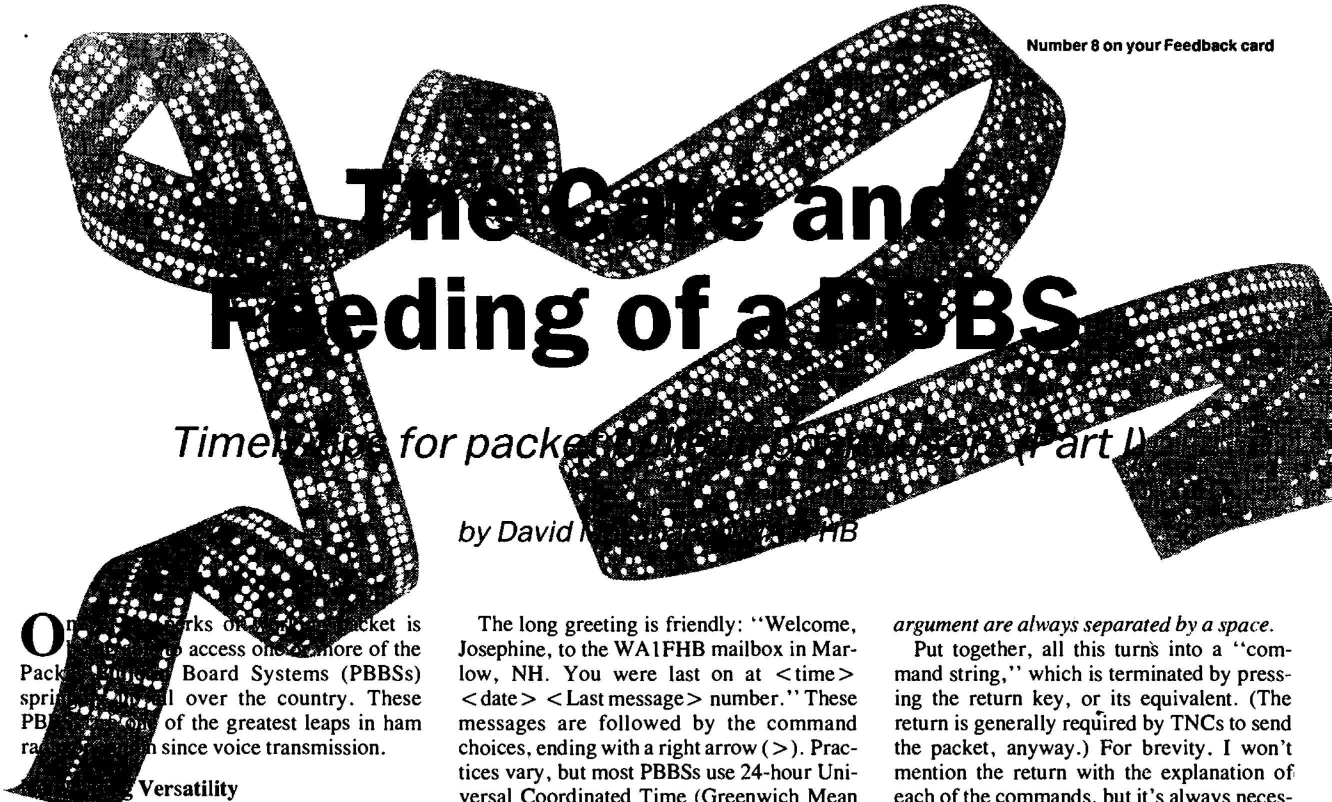


Figure 1. X-Y LED Driver.

Number 8 on your Feedback card



The Care and Feeding of a PBBS

Time[illegible] for pack[illegible] (Part I)

by David [illegible]HB

On[illegible]rks o[illegible]cket is [illegible] access one [illegible]more of the Pack[illegible] Board Systems (PBBSs) spri[illegible]l over the country. These PB[illegible] of the greatest leaps in ham ra[illegible]n since voice transmission.

[illegible] Versatility

The PBBSs offer two exciting features never before available to hams. They are an electronic means of disseminating general information—ARRL and AMSAT bulletins, notices of club meetings and events needing amateur communications help—to the ham community without being tied to a net or bulletin schedule. There is also the capability of leaving personal messages for other hams who are not on the air at that particular moment (and receiving similar messages from other hams). These messages can be forwarded automatically from one PBBS to another, even over transcontinental or transoceanic distances.

How does a ham get involved? Bulletin boards can at first daunt a new packeteer. Many hams have little or no experience with computers and their demand of exactitude from the operator.

Logging On

To log onto a board, a packeteer needs only to connect with it. The board does the rest, greeting him in one of several ways and, perhaps, telling him that he has new mail.

The PBBS software provides for two greetings, long and short. (The short one is sometimes called the "expert" greeting.) Both of these can be personalized for the individual PBBS and, if the operator of the board likes, changed periodically to draw attention to some important event or matter. The selection of the long or the short message for a particular user can be changed either by the user (with the "NE" command) or by the PBBS operator.

The long greeting is friendly: "Welcome, Josephine, to the WA1FHB mailbox in Marlow, NH. You were last on at <time> <date> <Last message> number." These messages are followed by the command choices, ending with a right arrow (>). Practices vary, but most PBBSs use 24-hour Universal Coordinated Time (Greenwich Mean Time to the older of us!), identified by a "z."

Long greetings, however, can take forever to get through during periods of heavy QRM and/or heavy activity. Even during good conditions, the long version wastes the operator's (and the channel's) time. A budding packeteer should move on to the short greeting as soon as possible. Here's an example of the terse prompt:

COMMANDS

With either prompt, the PBBS commands are exactly the same. The commands are single letters that may be followed by a modifier or an argument or, often, both. Please memorize: *A command and its modifier are never separated by a space, but a command and an argument are always separated by a space.*

Put together, all this turns into a "command string," which is terminated by pressing the return key, or its equivalent. (The return is generally required by TNCs to send the packet, anyway.) For brevity, I won't mention the return with the explanation of each of the commands, but it's always necessary. Note also that, while I show all commands in capital letters for clarity, the board accepts either upper or lower case.

The command sets the basic operation the operator wants the PBBS to do. The modifier then selects a subcategory of that operation, and the argument designates the subject or victim of the operation.

Instant Help

The three most important commands for the neophyte are the ones for assistance. The first is X, which provides a reference to all the other commands. At the long or the short prompt, X toggles a long command menu:

Note the word "toggle." A toggle key alternates a command between two states (such as "on" and "off"). The X command, for example, gives the long command explanation at each subsequent command prompt, until the user toggles it off by sending another X.

The H command downloads the system's Help file. This file may be customized to some extent for each system, but it generally runs about 36 lines of text. Those with a printer can turn it on before issuing the H command, to get a handy command reference to keep beside the keyboard. The Help file shown in Fig. 4 is an example, but those from other boards may be slightly different.

Finally, there's the I command, which accesses information about that specific PBBS—location, equipment, special interests, etc. Just don't expect the Info file to be up-to-date. It is generally prepared with great glee when the

```
:- Connected to WA1FHB

Hello Peg, Welcome to the wa1fhb Mailbox from David in Marlow, NH
Last on at 2153 on 871210, last message 2383.
X for long menu, NE for short prompt, H for help, L to list new msgs.
You have new mail:
Msg# TR  Size  To     From    @ BBS  Date     Title
2383 PN     1 N1FBC  WB9EUJ          871213 I'll be there Monday!
2381 PN   244 N1FBC  WA1FHB          871213 Thursday?
2378  N   196 N1FBC  KB1HE           871213 Happy Holidays
N1FBC de WA1FHB: at 2053z on 871213 B,D,H,I,J,K,L,N,R,S,T,U,W,X >
```

Figure 1. Long sign-on.

```
N1FBC de WA1FHB: at 2054z on 871213 B,D,H,I,J,K,L,N,R,S,T,U,W,X >
```

Figure 2. Short sign-on.

```
N1FBC de WA1FHB: Date 871213 Time 2053 Last msg # 2382, 109 active msgs
Messages: L - List, R - Read, S - Send, K - Kill
Files:    W - What, D - Download from, U - Upload to
B - Bye, H - Help, N - Enter your name, T - Talk to David
I - Information, J - Calls heard,  X - Short/Long Menu >
```

Figure 3. Long Menu.

board is first put on the air, then totally forgotten as system antennas, towers, rigs and computers come and go.

The Main Commands

These are the commands that actually make the PBBS function. Most of them require an argument.

The first command the user should issue when he accesses a PBBS for the first time is the "name" command. It takes the form "N Ayleen <return>" (using your own name, handle, or alias, of course) and enters your first name into the user file. This has two purposes. In a later connect, it impresses the uninitiated guest to a PBBS demonstration. It also "introduces" the user to the PBBS operator. With a couple of computers in the middle, packet PBBS operation is probably the most impersonal of all the activities in an otherwise friendly and personal hobby—fight the trend!

At the first log-on to a particular PBBS, the board asks the user to specify a home PBBS with the NH command (this concept to be discussed later). If the user isn't sure which board he wants as his home board, he should pick one anyway, since the log-on prompt will keep bugging him for an entry. Simply choose one for the moment, keeping in mind that it's easy to switch. The user should just be sure that if he checks into more than one board, he should specify the same home PBBS on all.

Information, Please

The L command, in various forms, is used to display messages in the PBBS's Mail Box. Surprisingly, the simple, unadorned L command (with no modifier) tends to confuse people. It lists only the messages entered since last log-on. If the packeteer was on the board several hours ago and there hasn't been much activity in the interim, or if she connected over a poor path, then try again using a different digipeater string, an L will come up blank ("None Found," or similar). He needs to use modifiers to dig down into the messages.

LM gives all traffic to or from the logged-on call. LA produces a list of ARRL bulletins, LB lists non-ARRL bulletins, and LT shows NTS traffic on the board. To check on messages to or from another call, use L> W1XXX (messages to W1XXX) or L W1XXX (messages sent by W1XXX). L 789 will show all messages with numbers greater than 789, and LL 10 will list the most recent 10 messages, regardless of message number. None of the List commands will show private messages except those to or from the logged-on call.

An operator can save time (his, the board's and the channel's) when using two-letter L commands (LA, LB, LM, and LT) by limiting the search to the highest message number on the board during his last connect (i.e., LM 5450). This keeps the already-viewed messages from reappearing on the screen. (All of these searches go from most recent back in time, and there's no legitimate way "new" messages could have gotten in to the older part of the listing.)

```
This is wUrli 12.0 software. Thanks to Hank for writing it.
Simple commands consist of one or two letters and a RETURN.
The second letter of a command is called a qualifier. Some
commands accept arguments. To add an argument, type a SPACE
after the command or qualifier and then type the argument(s).
UPPER/lower case doesn't matter, but command (string) must end
with ENTER, <cr>, or RETURN.
Uo NOT put a space between a command and a qualifier.
For example -- The "L" command lists the messages in the mailbox.
Type just "L" and a RETURN to list all the messages entered since
you last logged in. If there are no NEW messages, you'll get a
"*** None found."
To list just your messages, type "LM" and a RETURN. (The "M"
stands for "Mine".)
To list only messages higher than a particular number, such as
4325, type "L 4325" or "LM 4325". Don't forget the space. This
form is preferred over the plain LM above (faster).
Some other examples:
  SB to send a bulletin message.
  LM 4325 lists only your messages later than 4324.
  LB 4325 lists only bulletins later than 4324..
  LT lists only NTS traffic.
  LL 10 lists the last 10 messages.
  R 3210 to read message 3210.
  K 5432 kills message 5432. (Only works with your messages!)
  KT 5678 kills 5678 (Only works with NTS messages).
  KM kills your messages. *** Please do NOT use! Use K <number>.
  S WORLI to send a message to WORLI.
  SP WORLI to send a "private" message to WORLI.

  N Joe       tells the MailBox that your name is "Joe".
  NH WORLI    tells the MailBox that WORLI is your Home MailBox.
  NE          tells the MailBox to change your Expert status on or off.

A more complete description of how the use the MailBox is in the
file DOC.TNC

Use the D command to download this file:
 D DOC.TNC

Please leave any comments as messages to walfhb.

     Have Fun!  -  David
```

Figure 4. Help file.

```
Msg# TR  Size  To     From   @ BBS  Date     Title
2381 PN   244 N1FBC  WA1FHB         871213 Thursday?
2378  N   196 N1FBC  KB1HE          871213 Happy Holidays
2375 TN   309 NTS037 WA2SPL WA1FHB 871213 QTC:NEWPORT NH
2374 BN   532 ALL    N1DYF          871213 GSARA Novice course
2373 BN   286 NEPRA  N1DKF  WA1FHB 871213 A1 Seare, W1ZHC, SK
2372 TF   232 05445  KA1CRX KD1R   871213 NR707 CHARLOTTE VT
2360 BF   291 NEPRA  N1DKF  KD1R   871213 A1 Sears, W1ZHC, SK
2359  F   551 KA2VCS K3PS   KD1R   871213 TNC-1 (@ KD1R-1 IN VT.)
N1CB tried to connect.
2054, fhb,109 msgs>
```

Figure 5. Message listing.

Here is a display of the result of any of the message listing commands. (The second-to-last line is not part of the message listing.)

The message number comes first. Use that number to read or kill a message. The next column shows the message type and status. The status will be /Y/ for already read (by the addressee), /N/ for not read yet, or /F/ for already autoforwarded to another board. (Boards can be set to kill messages that have been forwarded.)

The column after that displays the message size in bytes, to give an idea of how long it would take to transfer. (A common error is misinterpreting the message size figure as the message number.) Next is the call of the addressee, the call of the sender of the message, and then the optional call of the "home PBBS" of the addressee, followed by the title of the message.

Temporary Data Storage

As the packeteer sits before his monitor perusing the messages, he probably comes across information he wants to write down. There is a quaint, old "low-tech" device I recommend for the purpose: the "Magic Slate." This children's novelty is generally available in five-and-dime stores. It consists of a wax-covered cardboard with a translucent plastic overlay. He can write on the overlay with a stylus or even a fingernail. Lifting the overlay erases it, but, of course, it is non-volatile in the event of power failure.

The Magic Slate is a super place to record the numbers of new messages on a PBBS log-on when reading the first message will probably scroll the other numbers off the screen. Similarly, it's handy for recording interesting file names for sequential down-loading from the PBBS. Put the Magic Slate to good use will prevent load the channel unnecessarily with repeated message listings and directories!

Sending a Message

Most packeteers are anxious to try out this function. Sending isn't difficult, but a little homework with the computer documentation before logging on can go a long way; before logging on, one must determine how to send Control Z.

The common control to end and save a message is "Control Z" (z). For a simple-minded system like an old Teletype™, all one needs to do is find the "Control" key, hold it down while hitting the Z (lower case is fine) then release both. The more sophisticated terminal emulation programs, however, often assume that control characters are commands for them and not to be passed to the TNC. There may be a "lead-in" character to send first. Some boards accept /EX as an alternate message ending.

To send a message, enter S, one space, and the call of the addressee, at the command prompt. The BBS converts lower-case entries into upper case. (The board accepts S <return>, and then prompts for the addressee, but that's doing it the hard way.) Then a prompt for the "title" of the message appears. The program gives up to 80 characters for the title, but one or two short words will usually suffice. If the title is long, it causes line-wrap (use an extra line) every time somebody lists the messages.

When it gets the <return> at the end of the title, the PBBS prompts for the message text and gives the number that it is assigning to that message. Note that number to check the message after entering it.

Be aware of carriage returns when typing the message. Most users have 40-, 64-, or 80-column screens (that's the number of characters displayed in a full line of text or data). If the typed line length exceeds the number of columns on the reader's screen, most computers insert a "default" carriage return/line-feed at the end of the line, probably splitting a word. Some machines substitute the return/line-feed for a character of text. Of course, if this happens, Murphy's Law says that the replaced character will be the third digit of an essential and unlisted phone number.

When done with the message, send the all-important ^Z and a return, and wait. A following prompt indicates that the message has been closed and saved. If the channel isn't busy, check the message by sending an R, space, and the message number to read it.

If the prompt didn't show, assume that the CONTROL-Z didn't make it and the message hasn't been saved. There are several things that may have happened. It's possible that the terminal program went off into the weeds. Recovering it depends on the user's particular set-up. If only the computer is confused, unplug the cable between computer and TNC (so as not to inadvertently disconnect from the PBBS), then reset the computer and reinitialize the terminal program (and, of course, replace the TNC cable) within the three or four minutes the PBBS gives you before it times out and disconnects. If the CONTROL-Z is successfully sent the second time around, the message is saved.

This isn't good packet form and should be used only as a last resort, but if all else fails, turn off the set-up: radio, TNC, and computer. Reinitialize everything and let the bulletin board "time out" in three or four minutes and reset itself. Any message left on the bulletin board, however, will be discarded and gone.

There's one wrinkle to sending personal messages to a recipient on another PBBS. (Message forwarding is discussed in more detail next month). If possible, provide the call of the recipient's home PBBS. To do this, after entering the addressee's call, add a space, then an "at" sign @, another space, and the PBBS call: S WA1VMZ @ WA1FHB or SB ALL @ W0RLI.

Message Categories

There are several modifiers for the S command. (They show up in the "type" column mentioned earlier.)

SP sends a private message. This is not, of course, truly private since the message is sent over a public channel, and the PBBS operator can (and may well) read it. The L command, however, won't list it, except when the addressee is logged on. This makes the L listing for others shorter and more useful, and no one else can read the message over the air. If a friend's call appears in the "Mail for" beacon, but not in the message list, then the message was marked private.

ST is used for formal NTS traffic. The actual contents of the address and "at" fields for NTS messages is presently in a state of flux, with "NTS" plus the ARRL Section abbreviation (e.g., NTSWMA), five-digit zip code, telephone area code, and "NTS" plus the three-digit postal SCF (the first three digits of the zip) all being used in various area. Until this situation settles, determine and follow local practice.

The title of the message should contain the call and message number of the station putting the message into the packet system as well as the *destination* town and two-letter state abbreviation. The normal NTS message preamble should form the first line in the message body.

SA is reserved for official ARRL Bulletins. SB is for general (non-ARRL) bulletins—AMSAT, local club and so forth.

Bulletins

Bulletins are often addressed to ALL. Take care to not use ALL too readily. The title can often target a specific group: AMSAT, ARES, etc.

If a bulletin announces an event (meeting, hamfest, exam session, or the like) put both the location and the date in the title. This saves "over the air" reading time, and helps the PBBS operator purge stale material. There's little as frustrating as reading an invitation to a great hamfest that took place last weekend!

```
Msg# TR  Size  To     From    @ BBS  Date     Title
1668 TN   222 NTSIA  KA1IFC          871119 NR 228 KA1IFC QTC Des Moines, Ia
NR 228 R KA1IFC 18 Baldwinville Ma Nov 18

Bob Kurtz
922 Boulder Ave
Des Moines Ia 50315

515 243 5493

Turkey day fast approaching x
Looking for a bird to
pluck and stuff x You
available query 88

Jean
```

Figure 6. NTS text message.

```
Msg# TR  Size  To     From    @ BBS  Date     Title
2335 SN   548 WB1GXM W1FJI           871212 308 wb1qxm qtc reno nevada
R:871211/2237z @:WB1DSW East Kingston, NH #:1191 O:W1FJI
R:871211/2054z @:K1UGM Wakefield, Ma #:2374 O:W1FJI
R:871211/2030z @:W1AW Newington, CT #:2021 O:W1FJI
R:871211/1930Z @:WA2RKN #2108 [Hyde Park, NY]
R:871211/1927z @:AG3F Towanda, Pa #:5270 O:W1FJI Z:18848
R:871211/1916z @:AG3F Towanda, Pa #:381 O:W1FJI Z:18848 [HF]
R:871211/1616z @:WA5OZ1 #8008 : Alamo Gateway [San Antonio, TX]
R:871209/2032m @:KE7CZ Dewey, Az #:1715 O:W1FJI
R:871209/1854m @:W1FJI #2381 [Scottsdale, Az.] O:W1FJI
Msg  2371 taken from W1FJ1  by W1IBP  at 1854 on 871209
```

Figure 7. NTS service message.

Don't type in long bulletins to ALL on the local PBBS on-line, since it's impossible to edit. Prepare and format the message with a word processor (watching for carriage returns and other details), then log onto the PBBS and send the message as an ASCII file transfer.

Disable any error-checking, such as XModem protocol, that the modem program might like to use. First, the PBBS will not handshake with a telephone protocol. Second, it isn't necessary because packet provides its own error checking. Third, even if it worked, it would nearly double the channel load with XModem's single-character ACKs and NAKs that would have to be made into a packet.

Opinions and Diatribes

Bulletins needn't be limited to announcements of new facilities and club meetings. The first amendment to the US Constitution does not give anyone the inalienable right to publish their views on someone else's PBBS—the board is private property and under the control of its owner. Most PBBS operators, however, feel an obligation to allow and encourage discussions or debate on a wide range of subjects of interest to their readers, whether they, personally, agree or not.

Unless the operator of a particular board has said otherwise, feel free to enter bulletins or messages to ALL on any subject as long as they avoid the business and obscenity prohibitions of the FCC and are not direct, personal attacks.

Follow these guidelines when entering opinions on the local PBBS: Keep them tight and to the point—less than, say, 2000 characters. Messages longer than that are time-consuming to read, even through just one digipeater, and are difficult to forward. Try also to use an honestly descriptive title. Misleading titles often anger and alienate people!

Lastly, pay attention to the presentation. If it's messy, with scattered thoughts, misspellings and poor formatting, its brilliant logic may not shine through and you will do your cause a disservice.

One-liners

Sometimes if a bulletin to ALL or a message is very short, the entire text can be squeezed into the 40 or so characters for the title. You wind up with a message of length 1 (that one is the ^Z that ends the message). "MAPRA Meeting Sunday!" or the like. If you see one of these, don't bother "reading" it with the R command. It's all in the title in the message list. The one-liner is also a way of leaving a short message for someone who may be connecting to the PBBS over a difficult path, because the title is sent prior to the first prompt.

The "message" will show up in every message listing and the addressee call will remain in the mail beacon until it's either read by the addressee (with the R command) or killed. A one-liner is sent the same as any other message. Send the ^Z and <return> when the board prompts you for the text.

Kill!

K <NUMBER> will kill message <number>. Before executing a K instruction, the board will check that the operator is either the sender or the addressee of that message. If not, the command won't work. Of course K won't work if the message is misaddressed-KI("eye")ZJH in place of K1("one")ZJH, for example.

There are several modifiers for the K command. KM will kill messages, KT <number> will kill NTS traffic and, on some boards, generate a service message back to the sender, giving the "killer's" call and the date/time the message was taken. 73

Next month: Disk files and mail forwarding.

Number 9 on your Feedback card

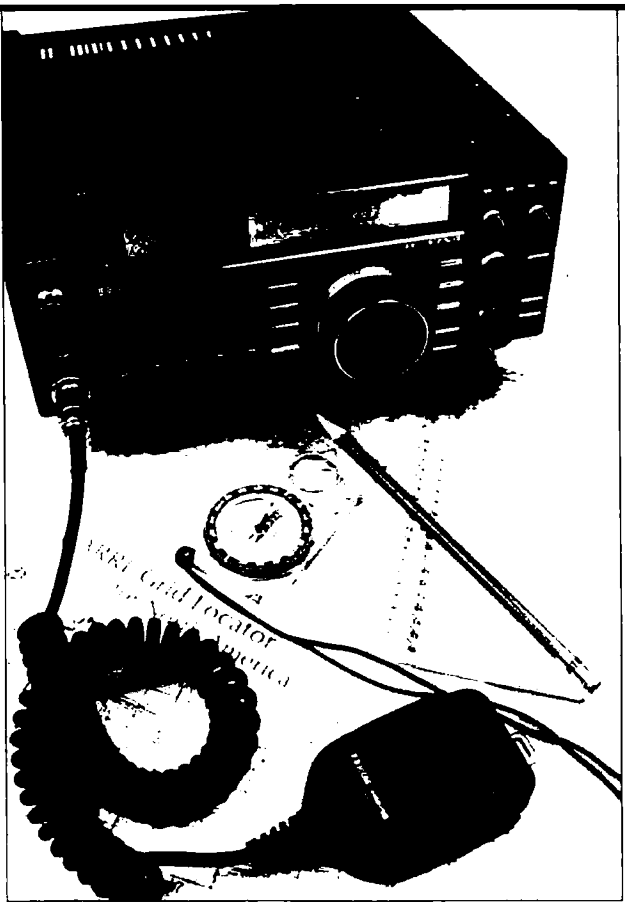
73 Review *by Pete Putman KT2B*

ICOM America, Inc.
2380 116th Ave. NE
Bellevue WA 98004
Price Class: $1400

ICOM IC-375A 220-MHz Multimode Transceiver

It's finally happened. All diehard 220 enthusiasts can now rejoice and revel in ICOM's latest entry into the VHF/UHF multimode market: The IC-375A transceiver. It's made exclusively for the North American amateur market.

Similar in design and operation to the IC-275 and IC-475, this radio offers a wealth of features for everyone, from the casual FM operator to hard-core packeteers. Considering this is the first time any company has manufactured such a transceiver, one has to be impressed with the sophistication of the design.



The ICOM IC-375 220-MHz multimode transceiver.

Overview

Figure 1 shows the front panel. Note the virtually identical copy of its sister transceivers for 2m and 70cm. The bright, backlit amber LCD display jumps out, showing frequency, VFO, memory channel, RIT, tone squelch, duplex offset, and mode. The frequency selection dial sits beneath the display, and has silky-smooth operation over a variety of tuning increments.

Modes

The 375 has four modes: FM, LSB, USB and CW. Pushing the CW mode switch again enables the optional CW filter (500 Hz), which the operator can use in conjunction with the Passband Tuning (PBT) and Notch controls for enhanced selectivity. Provision is made to switch a tower-mounted preamplifier from the front panel (maximum power: 100 watts) as well as to enable a built-in speech compressor. There are also two speeds of AGC selection.

The user can select sub-tone frequencies on both receive and transmit, and store any combination of offsets, sub-tones, modes and frequencies in 99 seperate memory channels—more than adequate for everyday use. Two priority channels are also available which store similar data.

RIT (Receiver Incremental Tuning) is standard and permits a shift of up to 9.9 kHz either side of the displayed frequency. The RIT can be cleared to zero offset at the touch of a button. This feature works in all modes, including FM.

"... the user can adjust the tone of his transmitted audio and set the degree of compression in the speech processor."

Additional controls set up the microphone gain (not deviation), RF output power, RF gain, CW keying delay, meter display, and AF tone quality from the built-in speaker. The AF gain and squelch controls are located to the right of the display meter, directly below the main power switch, in order not to confuse them with any other controls.

Several scan rates are available. The standard band scan is incorporated, along with programmable range scanning, selectable mode scanning through memories, and general purpose memory scanning. A skip button allows the operator to lock out undesired channels when in scan mode. When using the programmable scan function, transmitting or touching the main tuning dial erases the preprogrammed band limits.

As on all new ICOM multimodes, the 375 has full break-in keying (QSK). Current activity levels are presently too low for QSK to be really useful now. In many cases also, full break-in keying isn't usable due to sequenced switching of amplifiers and external preamplifiers. The optional AG-30 mast-mounted preamplifier won't function when full QSK is selected either. Semi break-in is also available with the drop-out delay set from the front panel. Note that no VOX operation is available—none of the new '75 series transceivers offer it.

The DATA switch on the 275 and 475 is also available here. ICOM claims a switching time of less than 5 milliseconds, which should be ideal for packet operation. Packeteers will not be able to use an external amplifier or preamplifier, however, due to this rapid switch time. The IC-375 also runs AMTOR, conventional AFSK RTTY, and SSTV.

A small insert with the IC-375A tells of the availability of the ICOM CIS (Communication Interface System), permitting control of these radios through a personal computer and RS-232 port. Such control permits displaying and operating the frequency, mode, memory selection and scanning functions, among others. ICOM doesn't say, however, what

software is available to do the job, so look for it in the next few months.

The rear panel also has many controls. In addition to the CW keying speed, the user can adjust the tone of his transmitted audio (brilliant!) and set the degree of compression in the speech processor. The remote connection for the RS-232 interface is here, as well as two accessory jacks for the ICOM AOS automatic squelch system and ALC control/external keying/receiver output.

The operator can also monitor his SWR via a three-way switch on the rear panel as well as power output. Connections for a CW key and external speaker are found here using 2.5mm miniplugs, and the CW sidetone level is accessible here. The antenna connector of choice is the SO-239 "UHF" socket, which is pretty much standard on 220 equipment. Although the IC-375A comes with a built-in AC supply, the user can also access the 13.8 volt input directly for portable use with the supplied DC power cable.

Observations

I've had the IC-375 in my station for quite a few months now, and gave it a fairly hard run during the September VHF QSO Party. Over 50 stations were worked from this location using the IC-375A, a Mirage C1012 amplifier, and a single Cushcraft 220 Boomer at 60 feet. Most of my operation was on SSB and CW (I use primarily an IC-37 for FM work), and the transceiver performed flawlessly the entire weekend. I had to stop operating and switch feedlines on 220 halfway through the contest due to an extremely high SWR condition that apparently made · difference to the 375A.

CW was the main mode that weekend due to the generally terrible conditions and weak signals. I preferred the semi break-in mode and use a special eight-pin DIN to RCA plug cable to switch the C1012. The 375A, by the way, keys an external amplifier by pulling it to ground, which is fairly standard practice. The eight-pin plug is similar to the one used by Kenwood. Since there was no available AG-30 preamplifier, I used the preamplifier in the Mirage with minimal results. The front-end sensitivity of the 375A is such that a preamp isn't needed most of the time. However, the S-meter is just as "dead" as on the 275 and 475, as the reader will soon see in the test data.

"The front-end performance of this particular unit. . . is not on a par with the IC-275A and IC-475A."

In practice, I set the AF Tone control at about 10 o'clock to eliminate a high-frequency hiss present with no signals and the squelch open. The speech compressor didn't seem to make much difference on distant contacts. It took as many tries to work weak stations with compression on as it did with compression off. The RIT control is a real help on 220, especially with all the older stations that drift out of the passband.

I used the Programmable Scan to set up limits of 220.080–220.150 MHz so that the radio was always seeking out new stations while I was on other bands. Most of the activity on 220 SSB or CW occurs during the activity hours at 0800Z and 2000Z with the band fairly quiet otherwise. Using this scan feature allows the contester to keep an extra "ear" on the band in case of an opening or a new grid square.

Received signal reports were favorable regarding the crispness of the audio as well as clarity. Based on these reports, I set the MIC GAIN control at 12 o'clock and left it there permanently. The supplied microphone is the ICOM HM-12 scanning type, allowing remote up/down selection of frequency. Serious contesters may wish to go with the optional SM-8 base station microphone and a footswitch, leaving the hands free for logging and tuning. (ICOM also makes the SM-10 microphone with a graphic equalizer and speech compressor.)

Performance

The following measurements were taken with an HP608F generator, Boonton 92 millivoltmeter and Bird 43 wattmeter. Power source was the internal AC supply. Take note, however, of two points.

- The IC-375A transmits across the entire specified range, but power output falls off significantly outside 220–225 MHz.
- Receiver compression point was significantly lower than on similar IC-275A and IC-475A models. See the sidebar.

Conclusions

The IC-375A represents a significant step forward in 220 MHz technology. There is no other comparable product that exists today. ICOM has built every possible feature into this transceiver to cover the wide range of operations and modes on 220 MHz. Its output power is sufficient to drive both solid-state and ground-grid tube amplifiers, such as the 8877 and 3CX800, to near the legal limit.

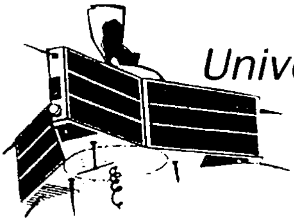
The front-end performance of this particular unit, however, is not on a par with the IC-275A and IC-475A. It took considerably less signal to drive the front end into compression, and this might mean some noticeable intermod products during contest operation, or when strong adjacent channel signals are present such as television channels 12 or 13.

I noticed a slight amount of AGC "pumping" during contest operation when other strong signals were present, but it didn't degrade front-end sensitivity that much. The external preamp might make this situation worse depending on its particular compression characteristics. Indeed, switching my external JFET preamp inline during crowded band conditions did just that.

Still, for the serious UHF operator, the IC-375A is a great way to go for multimode operations. The overall design and performance combined with ease of operation makes this an excellent choice of transceiver.

Specification			**Claimed**	**Measured**
Frequency Coverage:	Transmit:		216–236 MHz	216.00–236.00 MHz
	Receive:		same	same
Output Power:	220.100	High	25 watts	28 watts
		Low	2.5 watts	2.5 watts
	223.50	High	25 watts	25 watts
		Low	2.5 watts	2.5 watts
Receiver Sensitivity:				
USB/LSB/CW	10 dB S/N @ 220.100		<.28 uV	.2 uV
	10 dB S/N @ 223.50		<.28 uV	.2 uV
FM	10 dB S/N		<.18 μV for 12 dB SINAD	.2 μV for 12 dB SINAD
Signal for "S9" reading			n/a	3.5 μV
1-dB compression/output			n/a	−9 dB
Conversion Gain, First RF Amp/Mixer			n/a	18 dB
Selectivity, SSB/CW			2.3 kHz/6 dB	n/a
			4.0 kHz/60 dB	n/a
Selectivity, FM			15 kHz/6 dB	as claimed
			30 kHz/60 dB	as claimed

UoSATs: The British Connection Part 2



University of Surrey's Contributions to Hamsats

by Robert J. Diersing N5AHD

Whole-orbit Telemetry Format

In late 1985 and early 1986, both UoSAT spacecraft began to operate under the control of a diary program stored in the on-board computer (OBC). This control program allowed much more flexibility in scheduling the activities of the OBC and data types transmitted on the downlinks. Consequently, whole-orbit telemetry surveys are transmitted very frequently from both spacecraft. The increased frequency of transmissions of whole-orbit data (WOD) make it more desirable to be able to decode and analyze this data. The amateur satellite enthusiast can thus observe the measurements made by onboard sensors when the spacecraft is not within range of his or her ground station. It is important to understand that the whole-orbit data is merely an extraction from the standard telemetry channels that has been stored in the OBC memory.

The amount of OBC memory available for data storage is about 8K for UoSAT-1 and 32K for UoSAT-2. The duration of the survey is under control of the OBC as loaded by the UoS command station. If whole-orbit data is transmitted, the status message transmitted by the command diary will give the date and time of collection and the channels included in the survey. Note that UoSAT-1 and UoSAT-2 computer status messages shown in Figures 1A and 2A include data related to whole-orbit data collection. They show the time WOD collection began and what channels are included. Typical whole-orbit data from UoSAT-1 and UoSAT-2 can be found in Figures 1B and 2B, respectively.

Number of WOD Channels	UoSAT-1 High Serial	UoSAT-2 High Serial
1	0E48	
2	0720	
3	04C0	
4		07E8
8		0FD8

Table 1. The highest observed line serial numbers in WOD surveys for both spacecraft.

WOD Header Lines

There are some important observations to make about WOD surveys. First, each line consists of a four-digit line serial number followed by from one to eight three-digit telemetry channel values and a two-digit checksum. The only exception is the first line, serial number 0000h. In this line the telemetry channel value positions contain the channel numbers of the channels included in the survey. An inspection of the UoSAT-2 sample will verify this. Spaces have been inserted for readability.

0000 011 037 038 039 02

It should be noted that the channel numbers also appear in the status message. However, the date and time of collection can only be obtained from the status message and is not contained in the survey data itself.

The time span between successive lines is determined by multiplying the line serial number increment by the time required to digitize and transmit a standard telemetry frame at the current downlink data rate. Considering the usual downlink data rate of 1200 bauds, the digitize-and-transmit time for UoSAT-1 is 5.28 seconds, and for UoSAT-2 it is 4.84 seconds. Thus, the time between lines 0008h and 0010h in the UoSAT-1 example is (0010h − 0008h) × 5.28 and (0010h − 0008h) × 4.84 for the same lines in the UoSAT-2 example. The duration of a WOD survey can thus be determined by multiplying the highest line serial number by the same factors of 5.28 and 4.84. Various maximum line serial numbers recently observed are shown in Table 1. Both the time between measurements (lines) and the duration must, of course, be considered by any program that will plot the data.

Interleaved Transmission Scheme

The examples in Figures 1B and 2B were only short extractions from an actual WOD survey. Their intent was to show the general format for WOD. A typical survey from UoSAT-1 might consist of lines 0000h through 04C8h while one from UoSAT-2 could have lines 0000h through 0FD8h. The larger number of lines from UoSAT-2 is a result of the larger amount of memory available in which to store the survey. In actual practice, however, multiple sets of lines are transmitted as shown in Figure 3.

The data set with serial numbers 0001h through 0FD9h is transmitted following the data set with serial numbers 0000h through 0FD8h. There may also be a 0002h through 0FDAh set. The previous discussion of time between measurements still holds; i.e., the time between lines 0008h and 0009h is 4.84 seconds since the difference between serial numbers is one. The data is downlinked in this interleaved fashion so that burst errors during downlink reception can be repaired with the following set of "nearby" data points. This feature is particularly useful when observing the WOD in real time as the UoS command station does.

Checksum Validation

In order to verify the checksum, each pair of ASCII characters is taken as a hex byte value and summed. Using modulus 256 arithmetic, the summation should produce a constant result. In the case of UoSAT-1 whole orbit telemetry, the constant value is AAh, which is 170 decimal. For UoSAT-2 the value is BBh, which is 187 decimal. An example of the checksum validation procedure follows. It was taken from the UoSAT Spacecraft Data Booklet.[6]

```
COMMAND DIARY V1.1 IN OPERATION
UNIVERSAL TIME IS 12:54:42
DATE 28/02/88
ATED
MEMORY WASH POINTER AT 1FB5H
LAST CMD SENT BY COMPUTER WAS 29H TO 1
LAST CMDORECD BY COMPUTER WAS 7DH TO 0 WITH DATA 00H

CURRENT WOD COMMENCED AT 00:00:00
DATE 28/02/88
SURVEY INCLUDES CHANS 03,13,28,
```

```
00000030130286C
0008001373376B2
001000237337 6A9
00180023733376A1
00200013733769A
002800137337692
00300013733758B
003800137337682
00400013733767A
004800137337672
00500013733766A
005800137337662
006000137337653
007000237337649
007800237337641
008000337337638
008800237337730
009000237337728
009800237337720
00A000237337718
00A800237337710
```

Figure 1. Computer status information (1A) and Whole Orbit Data (WOD) (1B) collected from UoSAT-1. Note the status information includes start time and date of the WOD and specifies channels on which data has been collected.

```
COMMAND DIARY V4.6 IN OPERATION
UNIVERSAL TIME IS 03:49:27
DATE 28/02/88
AUTO MODE IS SELECTED
10 RAM ERRORS AT D519H
SPACECRAFT SPIN PERIOD IS -005BH SECONDS
LAST CMD SENT BY COMPUTER WAS 40H TO 1
LAST CMD RECD BY COMPUTER WAS 6DH TO 0 WITH DATA 00H

CURRENT WOD COMMENCED AT 00:00:00
DATE 28/02/88
SURVEY INCLUDES CHANS 37,38,39,47,48,49,57,58,

****!!!!!NEWSFLASH!!!!!****

WOD-DATES ONE WEEK OLD, CHANNELS OK
DE PA3BHF

DIGITALKER ACTIVE
```

```
00000370380390470480490570588C
000842447250346550146449448812
001042447250345950146449448816
001842447150245650046349448815
00204244715024545004634944880F
002842447150245250046349448809
003042447150245150046349448802
003842447150244950046249448803
0040423471502448500462494488FD
0048423471502447500462494487F7
0050423471502447500462493487F0
005842247050244649946249348753
00604224705024454994614934874D
006842247050244449946149348746
007042147050244349946149348740
007842147050144349946149348739
008042147050144249946049348733
00884204705014424994604934872C
00904204695014414994604934862D
00984194695014404984604934862E
00A04194695014404984594934862D
00A841946950144049845949348625
00B041846950143949845949348625
00B84184695004394984594924861F
```

Figure 2. Computer status (2A) and Whole Orbit Data (2B) from UoSAT-2.

Consider the WOD telemetry line:

008851 1449621693FF

Take this line and add a zero ('0') in front of each three-digit telemetry value to get:

00 88 05 11 04 49 06 21 06 93 FF

Add together the first digit from each pair (remembering A = 10, B = 11, etc.) and multiply by 16:

$16 \times (0 + 8 + 0 + 1 + 0 + 4 + 0 + 2 + 0 + 9 + F) = 624$

Add together the second digit from each pair:

$0 + 8 + 5 + 1 + 4 + 9 + 6 + 1 + 6 + 3 + F = 58$

Add these two previous results together, divide by 256, and note the remainder.

$(624 + 58) \div 256 = 2$ with remainder 170

Lines producing the correct result when subjected to the validation procedure should represent correct data. The UoSAT-2 WOD should produce a remainder of 187 (BBh).

Merging Data from Multiple Orbits

Rarely can a complete WOD survey be captured in a single pass. This is usually due to a combination of two factors. The first is marginal reception due to low elevation passes and/or local interference with the downlink signal. The second is the switching of the WOD on and off the downlink by the OBC resulting in insufficient data capture.

The solution to this problem lies in the merging of data from orbits where the same WOD survey has been transmitted. Care must be taken that the WOD is from the same survey as indicated by the OBC status message. Table 2 shows data from several orbits collected at my station.

For UoSAT-2, a new WOD collection had already begun for the UTC day prior to the first visible pass. This can be seen by referring to the UoSAT-2 data in the preceding table. Note that the highest line serial number for orbit number 12089 is 090Ah, and for orbit number 12090 it is 0D99h. This is because WOD collection was in progress when the data was captured. When monitoring the downlink in real time, "WHOLE ORBIT DATA COLLECTION IN PROGRESS" will be seen in the OBC status messages until the survey has been completed. For listeners in the United States, the best orbits for WOD collection will be the morning passes, since the survey will have been completed by then. Occasionally, a new WOD survey will start around noon UTC, but this is not common.

The same comments apply to UoSAT-1 with one notable exception. The difference is that frequently a new WOD survey is initiated between passes visible in the US, since this is when UTC midnight occurs. This can be seen in the preceding table. Orbit number 27162 occurs on 08/25/86 while orbit number 27163 occurs on 08/26/86. The highest line serial number is again lower on orbit 27163, indicating a WOD survey is in progress.

A Look Ahead

The UoSAT Spacecraft Engineering Research Unit at the University of Surrey (UK) is now building a third UoSAT-OSCAR spacecraft–UoSAT-C. NASA has agreed to provide a launch for UoSAT-C on a DELTA launch vehicle currently scheduled for late 1988. The DELTA should place UoSAT-C into a 43-degree inclination, 500 km circular orbit.

Like UO-9 and UO-11, UoSAT-OSCAR-C will support a world-wide user community of engineers, scientists, educators and communicators. If all goes according to plan, UO-C will provide spacecraft housekeeping telemetry, long-term telemetry surveys, results from on-board experiments, news bulletins and communications facilities on a single downlink through packet-radio techniques. The UoSAT Spacecraft Research Unit will finalize and publish communications modem and protocol details as soon as possible to allow ground stations to equip themselves.

```
00000110370380390 2
0008345439481 51391
001034443948151 38A
0018344439481 51382
002034443948151 37A
002834443948151372
003034343948051 36C
003834343948051 364
......
0FD0332440474510D6
0FD8332440474510CB

000134543948151398
000934543948151390
001134443948151389
002934443948151371
003134343948051 36B
003934343948051363
004134343948051 35B
004934243948051354
......
0FD1332440474510D6
0FD9332440474510CB
```

Figure 3. Example of multiple data sets from UoSAT-2. UoSAT-2 has 32K memory for data collection versus 8K on UoSAT-1.

UoSAT-C, like the previous UoSAT missions, will have a strong element of international collaboration–specifically with members of AMSAT-UK, AMSAT-NA in the US and Canada, VITA, Quadron, NASA, the British National Space Centre and the European Space Agency.

Store & Forward Communications

Since 1983, UoSAT has played a major role in an international collaborative project developing cost-effective digital store-and-forward satellite communications techniques. The UoSAT-OSCAR-11 Digital Communications Experiment (DCE)—funded by the Volunteers In Technical Assistance (VITA) and built by VITA/AMSAT volunteers in the USA, UK and Canada—provided the first operational tests of store-and-forward PACSAT communications within the Amateur Satellite Service. Drawing on the operational and engineering data gained from the DCE, UoSAT and VITA are developing a high performance digital store-and-forward communications payload specially tailored for use by inexpensive ground stations. To test this payload, UoSAT-C will carry the PACSAT Communications Experiment (PCE). The PCE will be openly accessable to Radio Amateurs operating in the 2m and 70cm bands (Mode J). VITA is seeking additional frequency allocations outside the amateur bands to allow limited use of the UoSAT-C PCE by VITA ground stations in remote areas to provide technical assistance and disaster relief.

Radiation Studies Experiments

Microprocessor-controlled payloads such as the PCE cannot be built without VLSI semiconductors, and most recent and affordable VLSI devices have not yet been tested for space use. UoSAT-C will host several experimental payloads studying the effects of the space radiation environment on VLSI devices.

UoSAT-1 Data			UoSAT-2 Data		
Orbit No.	Date	High Serial	Orbit No.	Date	High Serial
27162	08/25/86	049A	12089	06/07/86	090A
27163	08/26/86	0242	12090	06/07/86	0D99
27170	08/26/86	0722	12096	06/07/86	0FD0
27171	08/26/86	0722	12097	06/07/86	0FD9
			12098	06/07/86	0FDB

Table 2. A summary of UoSAT data collected at the author's location (27.28N, 97.24W).

•Cosmic Particle Experiment (CPE)—comprising an array of large-area PIN diodes, will detect energetic particles which cause single event upsets (SEUs) in VLSI circuits (such as high-density RAMs).

•CCD Single Event Upset Experiment—(CCD-SEU) comprising an enclosed Charge-Coupled Device (CCD) array, will detect energetic cosmic particles and evaluate the effect of SEUs on CCD imagers. This data is of particular importance for scientists using sensitive CCDs as star sensors.

•Total Dose Experiment (TDE)—using special FETs located around the spacecraft, will measure the total radiation dose accumulated by the on-board subsystems and payloads. These dose measurements will allow engineers to assess the shielding properties of the spacecraft structure, and to correlate changes in LSI-device power consumption and performance with total radiation dose.

Satellite Technology Experiments

UoSAT-C will carry a range of satellite technology experiments associated with power systems, on-board data handling (OBDH), attitude determination, control and stabilization (ADCS) and RF modulation.

•POWER—The spacecraft will be powered from GaAs solar cells and will include experimental patches of novel GaAs, InPe and Si solar cells with a variety of newly-developed cover-slides. The performance of these cells will be monitored throughout the mission as a function of radiation dose. The spacecraft onboard computers will constantly monitor and adjust the Battery Charge Regulator and Power Conditioning Module to optimize power conversion and storage efficiency.

•OBDH—UoSAT-C will include several computers. In addition to the primary RCA1802 on-board computer (OBC-1) running DIARY-type software, there will be a more powerful 80C86-based OBC-2 supporting complex attitude control algorithms and spacecraft data networks. Four TRANSPUTERS in a parallel-processing array will be available for highly sophisticated on-board image and data processing, and the PCE will employ an 80C186-family computer to manage high-speed communications links and several megabytes of RAM.

A wide range of memory devices using different technologies and architectures will make up a total on-board capacity of around five megabytes of RAM. The radiation-induced effects on the processors and associated memories will be monitored and evaluated throughout the lifetime of the spacecraft. The network of computers on UoSAT-C will make this spacecraft the most compu-

tationally powerful of its class and will support demanding experiments in advanced spacecraft attitude determination and control, data communications and image processing.

•ADCS—The 43-degree inclination, non-sun-synchronous nature of the UO-C orbit will necessitate the use of new attitude determination and control mechanisms to maintain accurate Earth-pointing. In addition to more complex attitude control algorithms executed by OBC-2, improved analog and digital sun sensors and Earth horizon sensors are being developed at UoS for the mission.

•DSP—If time and resources permit, a Digital Signal Processing Experiment may be included on UO-C to evaluate modulation/demodulation schemes.

A new concept of highly modular construction has been developed and is under test for UoSAT-C. This new, modular structure should result in much improved utilization of the available spacecraft envelope, greater ease of assembly and integration, and allow a more rapid response to future launch opportunities.

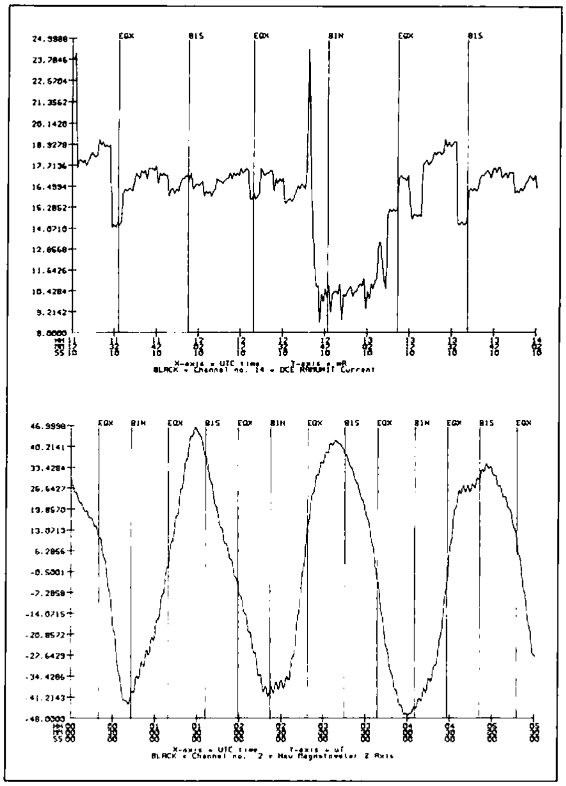


Figure 4. Two examples of Whole Orbit Data plotted against time. 4A shows magnetometer readings over 5½ hours, and 4B illustrates variations of the Digital Communications Experiment (DCE) RAM unit's current demand in milliamperes.

For More Information

Information about UoSAT operations can be obtained by copying the bulletins transmitted by the satellites. Examples of bulletins can be found in Figures 1B and 2B. These bulletins are usually updated on Thursdays so listening on the weekends will provide the latest information. The bulletins transmitted by UoSAT-2 are longer than those sent by UoSAT-1 since there is more RAM available for storing the bulletin text. The bulletins contain important information for all operational satellites.

Orbital information can be obtained from a variety of sources. The most popular method is to run predictions with the aid of a computer program. In the UK, programs for various microcomputers are available on both diskette and cassette tape from AMSAT-UK, 94 Herongate Road, Wanstead Park, London, E12 5EQ. In the US, programs are available for a number of microcomputers from AMSAT-NA Software Exchange, Box 27, Washington, D.C., 20044. The reference elements sets are available through the various AMSAT nets and publications.

The UoSAT Newsletter is published periodically by the University of Surrey Electrical Engineering Department. It is sent to those who have a record of serious interest in using the UoSAT spacecraft. A complete description of the UoSAT-1 experiments was given in the August/September 1982 issue of *The Radio and Electronic Engineer* published by the Institution of Electronic and Radio Engineers, London. Another comprehensive description of UoSAT-1 can be found in *UoSAT: The University of Surrey Satellite Project* published by the UoS Department of Electrical Engineering. Another issue of *The Radio and Electronic Engineer* has recently been devoted to the UOSAT-2 spacecraft. Copies are available from AMSAT-NA and AMSAT-UK.

Publications available in the US containing information about UoSAT are *QEX/SAT* published by the American Radio Relay League, and *Amateur Satellite Report (ASR)* and the *AMSAT-NA Technical Journal (ATJ)* both published by AMSAT-NA. *ASR* is a membership service and is published every two weeks. *ATJ* is published twice yearly in January and July and contains high-level engineering and scientific papers related to amateur radio and other low-cost spacecraft projects. ■

Acknowledgements

The material in the sections on UoSAT-C Mission Profile and UoSAT-C Payloads is taken directly from the public announcement of the UoSAT-C mission prepared by Dr. Martin Sweeting, G3YJO, Director of Satellite Engineering at the University of Surrey, England.

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N5AHD is Associate Professor of Computer Science at Corpus Christi State University, 6300 Ocean Drive, Corpus Christi TX 78412.

Number 11 on your Feedback card

Buyer Beware!

But you don't have to be infallible

R.C. Lukaszewicz WD8RCL

Have you ever bought a piece of gear that did not live up to the seller's claims? There is a solution to get your money back or to recoup repair costs!

Buying used equipment carries the risk of inheriting someone else's troubles. Unfortunately, not all hams honestly represent their hand-me-downs. Here are some pointers to avoid being left "holding the bag."

I am not an attorney and I am not attempting to provide legal advice regarding the matters put forth in this article, but my experience could offer some valuable lessons.

The Transaction

A short time ago, I heard a ham announce over a 40 meter net that a five-year old, 25 watt, synthesized, two meter mobile was available for $165. I called him on the telephone to question the condition of the radio and if the price was negotiable. After speaking with the seller, I was convinced that the only flaw with the radio was a bulb that had reached the point of no return in the T/R meter. The price was not negotiable, and I believed that the radio functioned properly. Eventually, I followed through and made arrangements to examine the rig at a Swapmeet.

We met, and I examined the radio. Unfortunately, there were no provisions for testing the rig, and again I questioned the seller on its condition. I was given a verbal guarantee that nothing but the bulb was inoperative. Also, the seller claimed he had used the rig daily in his home without a problem. I thought that since this statement came from a fellow amateur, it was good enough for me. I paid the owner his full asking price of $165 in cash.

The Ultimate Test

Upon arriving home, I immediately connected the unit with my Bird wattmeter in line. I quickly discovered that the maximum output power was a mere eight watts, the T/R meter was not operating in the receive mode, and there was objectionable audio distortion on receive.

Immediately I called the previous owner and explained the problems. He agreed to make amends and reluctantly agreed that the T/R meter was not functioning on receive. We agreed to talk the following day with information on repair options.

The next day I was armed with as much information I could accumulate for the repair cost of the unit on short notice. I called the previous owner again and courteously asked that he either repay the cost of the unit or provide me with a modest $45 to partially cover repair costs (one hour of labor at the original equipment manufacturer).

The seller said that he would not take the radio back and would not pay the $45 for partial repairs. In closing, he said that I had purchased the rig "as is" and had to live with the problems. I responded that I did not buy the radio "as is." I had a verbal guarantee, and I believed it was now necessary to take him to Small Claims Court to resolve the matter.

Preparation for Court

I immediately prepared a letter to the previous owner, which included all the facts of our dealings, and sent it via registered mail and requested a return receipt. The letter was refused, which is an option of the addressee. I then filed a court claim for the sum of $45 for the in-factory repair, $21 for the estimated replacement of the final power amplifier, and $20 court costs for a total of $86.

I then obtained a written quote from the manufacturer highlighting the cost of examining the radio. I obtained the FCC rule book and highlighted Part 97, ownership Subpart-C Technical Standards, section 97.67, Maximum authorized transmitting power subsection(a) and subpart E-Prohibited Practices and Administrative Sanctions, section 97.121, False Signals subsection(a).

I gathered together the equipment specification sheet, the radio, power supply, antenna, Bird wattmeter and associated cables to demonstrate the radio in court if necessary.

Trial Day

At the trial I informed the court that the case was a matter of principle. I felt I could prove that the radio I had purchased was sold with the knowledge of it being a defective radio. I stated the facts, presented the refused, unopened registered letter, Specification Sheet, ARRL/FCC rule book, equipment examination estimate, and radio. The seller simply stated to the court that he was unaware of any problems with the radio.

I pointed out the meter on the face of the radio, and said that I felt it had to have been observed by the previous owner. I then pointed out that, per the rules and regulations, that the seller would have been operating illegally by not knowing his output or by transmitting false signals into a repeater by not having the T/R meter working. I then offered to set up the rig and demonstrated the power output deficiency.

This was all that was necessary for the court to rule in my favor. I received the full award of $66 plus court costs that I sought. I ultimately repaired the T/R meter and audio problem myself, with the power problem yet to be tackled.

Caveat Emptor

Here are some common sense guidelines to follow when considering a purchase of used gear.

- Thoroughly quiz the seller about the condition of the piece of equipment. Make certain about the condition of the gear before buying.
- Ask the seller if he would refund all monies if you are not totally satisfied with the equipment.
- Be certain to obtain the seller's complete name, address, phone number and call sign.
- Ask the seller if he will take a personal check with proper ID. Some sellers are willing to take a check if they believe the equipment's damage was described properly. On the other hand, some amateurs have been inconvenienced by bad checks.
- Ask for a demonstration on the spot if possible.
- If you purchase through the mail, "sight unseen," be sure the seller will provide a return privilege in writing.

The Small Claims laws are different in many States, so check the options. Keep in mind, however, that it is not a joyous occassion to take a fellow amateur to court. Still, it is better to have the courts decide rather than taking the law into your own hands. Also, the time lost in attending court may not be worth the claim, and it then becomes a matter of principle.

Summary

It is wise to scrupulously check the piece of equipment as effectively as possible before buying it.

If you are ever taken taken advantage of, be patient in the effort to resolve the matter mutually between the buyer and the seller. If all else fails, the Small Claims Court may become the only alternative.

Remember, even if the equipment was bought "as is" and there are defects above and beyond what was bargained for, the damages may be reclaimed. If fraud can be proven, the seller of the equipment may have to rescind the deal or hand over the costs for the repairs.

Since laws in each state may be different, a consultation with an attorney may prove worthwhile before filing a claim.

Knowing there is solid recourse, I will continue to buy used gear and continue to look for those bargains.

A New Pulsed Bi-Phase Digital Communications System

19.2 kB in a 3 kHz bandwidth? Read on to see how!

by William Hotine K6HH

Amateurs have traditionally been the forerunners of radio progress. They have pioneered short waves in the 1920s, and single signal superhets and single sideband in the 1930s and 1950s. Well, the same pioneering can be done in digital telecommunication techniques!

This article describes a new technique of pulsed, bi-phase shift-keyed (BPSK) modulation that opens up the new field of narrow band digital radio. The system tailors new methods to fit the requirements of a narrow band system, and abandons the conventional method of 180° sinusoidal phase reversals, which produces a large number of sidebands and a consequent wide frequency spectrum of the signal. This wide bandwidth has been accepted in the past as a necessary evil of digital communication.

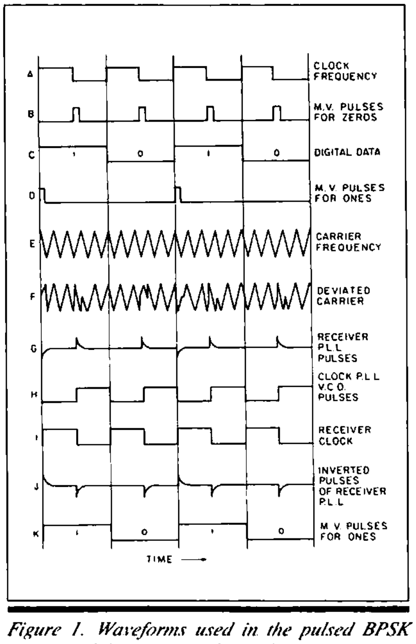


Figure 1. Waveforms used in the pulsed BPSK system and their timing relationships.

Small Phase Deviation

The key elements in the new pulsed BPSK modulation system are: 1) the very small phase angle deviation, and 2) the nanosecond linear transient of the phase modulation.

Hund[1] analyzed the sidebands generated by small phase deviations. At small phase angles of 0.2 radian (11.5°) or less, only two main sidebands, similar to AM sidebands, are generated. The modulating frequency f determines the sideband spacing from the carrier. The width of a sideband is the the modulating frequency variation, as in AM. Each sideband contains an equal amount of information. This allows PSK transmission on a single sideband (SSB) by using a small deviation angle and a bandpass filter to pass one sideband and reject the carrier and the other sideband. The width of this single sideband is reduced by a novel coding method that uses pulsed phase deviations of 0.02 radians (1.2°) to represent the digital information. The novel coding incorporates a timing pulse in every bit, which provides a coherent clock at the receiver enabling synchronous operation.

Synchronization

How does a receiver demodulate this single sideband without a reference carrier? By pulse coding the deviations to allow polarized pulsed detection in a digital phased locked loop (PLL) demodulator system. Binary "one" is encoded as a brief pulse of a leading phase angle at the start of a clock period and a brief pulse of a lagging phase angle at the middle of this clock period. Binary "zero" is encoded only as a brief pulse of a lagging phase angle at the middle of a clock period. This coding thus provides a timing pulse at the middle of every bit for directly transmitting the clock.

The phase deviations arise from the transitions at the rising and falling edges of the rectangular phase modulating pulses approximately 1µs long. The phase angle deviation during the nanosecond rise and fall of the modulating pulse is approximately 0.02 radian or 1.2°. The sine wave carrier is phase modulated during a very small portion of a single carrier cycle when using this method, so modulation products occupy a very small frequency spectrum.

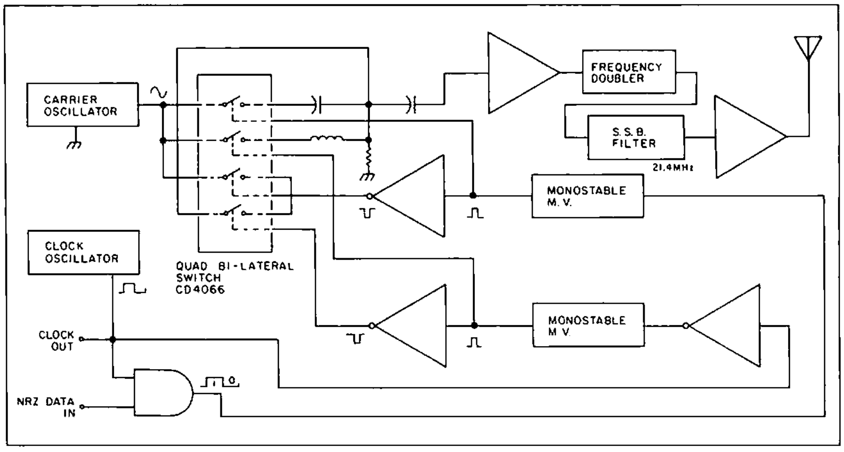


Figure 2. Transmitter block diagram.

TX Modulator

The wave shapes used in this system are shown in Figure 1. Figure 2 shows a block diagram of the transmitter's simple modulation system.

A sine wave oscillator feeds a one-volt signal through the quad bilateral switches to separate L and C phase shift circuits when these switches are pulsed. The sine wave remains unshifted during the intervals between the digital bit pulses. The square wave clock oscillator circuit drives an inverter, which in turn drives a monostable multivibrator (M.V.) to produce a "zero" modulating pulse at the middle of every clock cycle. This pulse drives a switch to connect the L phase shift circuit to produce a lagging phase angle.

The NRZ data input, clocked by the clock oscillator, drives one side of the AND gate while the clock frequency drives the other side. When a digital "one" appears at the gate, the AND gate drives a second monostable M.V. to produce a "one" modulating pulse at the start of a clock cycle. This pulse drives a switch to connect the C phase shift circuit to produce a leading phase angle.

Inverters driven by the pulses open the switches, which transmit the carrier directly for the pulses' duration. When no pulses are present at the inverter inputs, the inverters drive the two switches closed to transmit the carrier directly to the load R without phase shift. The load resistance is coupled to a high impedance input amplifier, the output of which drives a frequency doubler.

At this point, there is a carrier with two sidebands present. The sidebands are about 1% of the carrier amplitude. A crystal single sideband filter selects the upper sideband, and an amplifier feeds the narrow single sideband to the antenna.

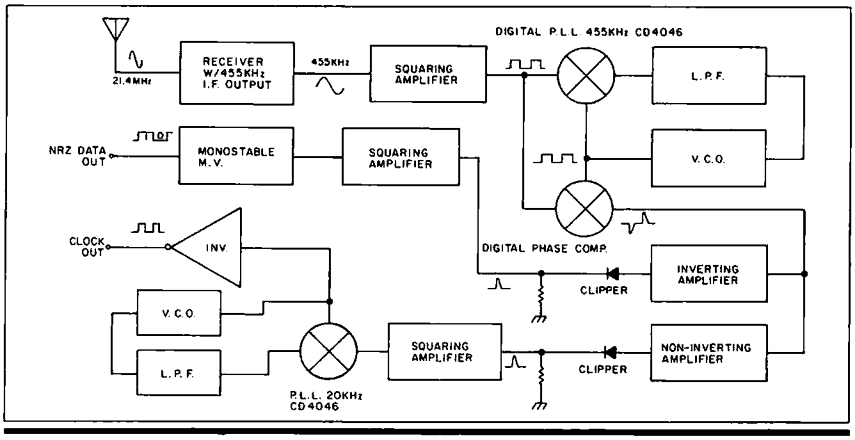


Figure 3. Block diagram of the pulsed BPSK demodulator.

At The Receiver

Here, the SSB sine wave signal at a 455 kHz intermediate frequency (IF) is amplified to make it a square wave at the logic level (Figure 3). The square wave is further squared by a Schmitt trigger, and its leading edge is compared to the leading edge of the PLL voltage-controlled (VCO) square wave in the digital phase comparator of a well-damped PLL by RCA. The signal square wave input is also compared in a second digital phase comparator with the PLL VCO. The second digital phase comparator gives a positive output pulse for a lagging phase angle input, and a negative pulse for a leading phase angle input. This allows unambiguous identification of digital "ones" and "zeros" without a reference carrier, not possible in previous PSK systems.

The digital PLL locks on to the frequency of the bit stream. An inverting amplifier then amplifies the negative output pulses denoting binary ones from the second phase comparator. A diode clipper removes the negative portions of the signal. The positive "zero" pulses are amplified to a square wave at the logic level. A PLL digital phase comparator then compares these pulses with the square wave output of the VCO at the clock frequency but 180° out of phase. An inverter brings the VCO output into phase and feeds the clock output terminal, thus furnishing a coherent clock for the receiver.

Bandwidth Limits

With this encoding method for a clock frequency f, a string of "zeros" gives the

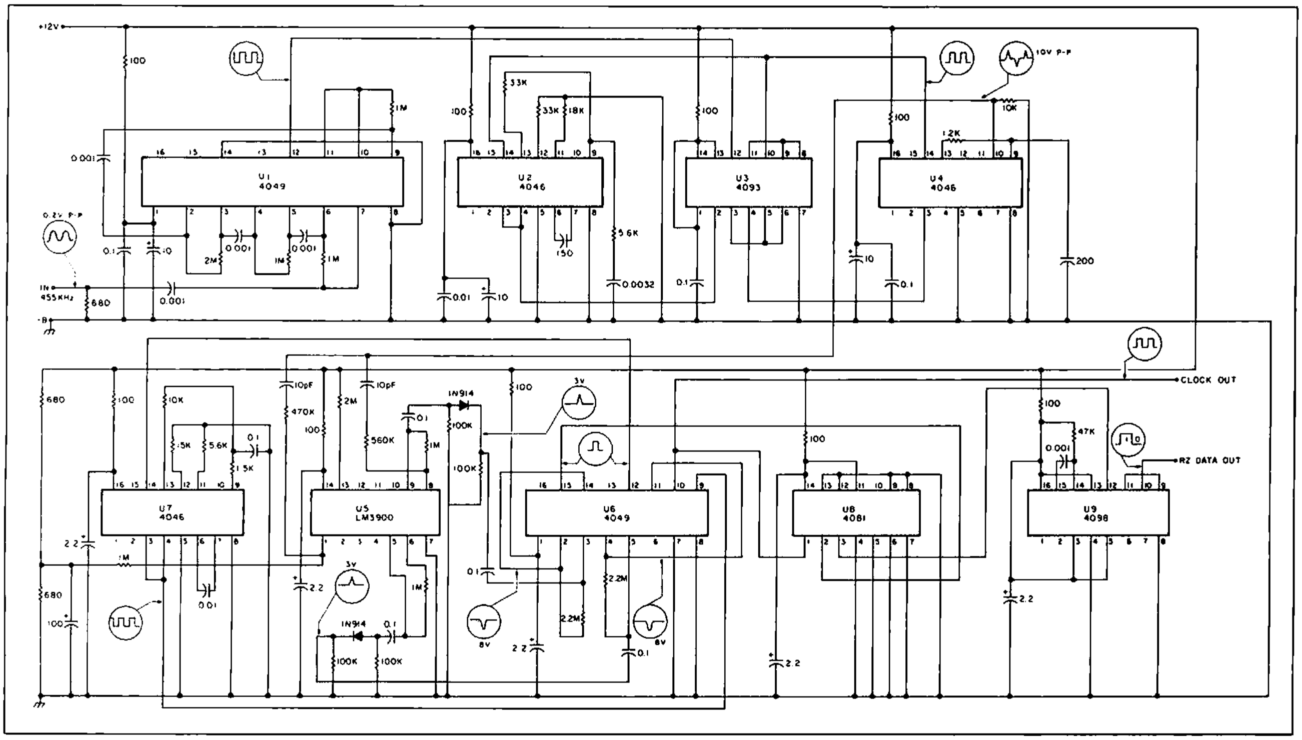


Figure 4. The transmitter schematic. It provides a pulsed BPSK output on 21.4 MHz.

inner sideband boundary as f$\Delta\theta$, where f is the modulating frequency, and $\Delta\theta$ is the phase deviation angle from the center frequency of the carrier frequency F. The outer sideband boundary is 2f$\Delta\theta$, for a string of "ones," which have two pulses per clock cycle. Then $2f - f\Delta\theta = f\Delta\theta$, the width of the sideband. As modulation takes place during the nanosecond rise and fall times of the pulses used, f is effectively multiplied by two. Since the deviation used is only 0.02 radian, and there are 2π radians in a cycle of the carrier frequency, this results in $(2 \times 20{,}000 \times .02) \div 6.28 = 127$ Hz bandwidth for a clock frequency of 20 kHz.

Prototype Characteristics

A working breadboard prototype has been operated at a carrier frequency of 21.4 MHz and a clock frequency of 19.6 kHz, an adequate speed for digital telephony or transmission of computer data. These benefits come, however, by sacrificing the high speed performance of the conventional 180-degree phase shift systems. It's a trade-off of speed for economy, simplicity, synchronous operation, and bandwidth. The experimental system is capable of synchronous transmission and reception of 6-bit digital telephony in a bandwidth formerly associated with CW transmission!

The breadboard system has the following characteristics:

- Transmitter—Carrier frequency 21.388 MHz
- Upper side band—21.400 MHz
- Clock frequency—19.6 kHz
- Digital input RZ or NRZ—12V data
- Power output—10 mW
- Receiver—Hammarlund HQ-101A with 455 kHz IF 0.2V P-P
- Receiver bandwidth—3 kHz
- Demodulator accepts 455 kHz 0.2V P-P sine wave
- Demodulator output—RZ or NRZ 12V data, 12V clock

System Construction

I bread-boarded the experimental system using standard Radio Shack #276-174 2" x 6" experimenter boards, with the ends trimmed off to fit the bottom of standard 3" x 5" x 2" aluminum boxes on top of a piece of ⅛" thick corrugated carton material, and glued in place. The carton material reduces capacity to ground.

Figure 4 is the schematic diagram of the modulator and carrier generator units. Q_1 is a standard crystal oscillator for crystal Y_1, which has a frequency of 10.694 MHz. Q_2 is a source follower and delivers a sine wave at about 1 volt to the 1.2kΩ resistor at terminal 1 of U_1, a quad bilateral switch.

Narrow pulses from U_4 drive control terminals 5, 6, 12 and 13 of U_1. When terminals 8 and 9 of U_4 are driven by a narrow positive pulse from pin 10 of one shot M.V. U_5. Pin 6 of U_1 receives this pulse and closes the transmission gate between pins 8 and 9, which feeds carrier voltage from terminal 1 to C_1 and R_1, shifting the phase of the carrier to a leading phase angle. The complementary pulse from inverter pin 10 of U_4 at the same time opens the transmission gate between pins 3 and 4 of U_1, which had been closed to transmit the carrier directly to R_1. Also, when pins 12 and 13 of U_1 are driven by a narrow positive pulse from terminal 6 of U_5, pin 12 of U_1 receives this pulse and closes the transmission gate between terminals 10 and 11, which feeds carrier voltage from pin 1 to L_1 and R_1, shifting the phase of the carrier to a lagging phase angle. The value of R_1 determines the phase angle.

The complementary pulse from inverter #11 of U_4 at the same time, opens transmission gate between pins 1 and 2 of U_1, which had been closed to transmit the carrier directly to R_1. When no pulses appear at pin 6 and 12 of U_1, as in the time between pulses, gates between 1 and 2, 3, and 4 are closed by the inverters, so the carrier appears across R_1 without any phase shift. The dual M.V. at U_5 gives "one" pulses from pin 10, and "zero" pulses from #6, 1µsec wide.

The clock oscillator U_2 has a square wave output at pin 10, with a complementary output at #11. Frequency divider U_3 is driven at pin 1 by the complement at pin 11 of U_2, and pin 12 is a divide-by-two output of the clock frequency. The square wave output of #12 of U_2 is inverted at terminal 3 of U_4, and can then serve as a test program of alternate ones and zeros when applied to terminal 2 of U_6 by switch SW_1.

The clock frequency square wave from pin 11 of U_2 is sent through three AND gates of U_6 to delay its leading edge until later than the trailing edge of the "one" pulse at pin 2 of U_6. This delay prevents a false "AND" output from pin 3. A small capacitor might be necessary from #9 of U_6 to ground to increase this delay in cases where clocked data signals are delayed excessively by the digital processor in use.

Pin 5 of U_5 is driven by the trailing edge of the clock pulse to produce "zero" pulses from #6 at the middle of each clock cycle. Terminal 12 of U_5 is driven by a pulse from pin 3 of U_6 when the rising edge of a "one" pulse and the rising edge of the clock pulse are "ANDed" at pin 3. In this manner, a "one" pulse is delivered at #10 of U_5 and a "zero" pulse is delivered at #6 of U_5 at the proper times to accomplish the coding of the phase deviations of the carrier.

Output Coupling

The carrier voltage on R_1 drives a source follower Q_3, with high input impedance, and its low impedance output drives the amplifier Q_4, which in turn drives the frequency doubler Q_5. Output tank L_2 C_2 is tuned to the second harmonic of oscillator Q_1. A few turns on L_2 serve to couple to the output terminal at low impedance.

The output terminal and ground are connected by twisted pair to the input of the single sideband filter unit shown in Figure 5. The six-pole crystal filter centered at 21.400 MHz has a bandwidth of 12 kHz and drives a high impedance input amplifier Q_1. Amplifier Q_2 drives the output stage Q_3. Output tank L_1 C_1 is tuned to 21.400 MHz. A few turns on L_1 are used to couple to a few feet of antenna wire adequate for the 10-milliwatt experimental transmissions.

Bill K6HH received the callsign 2WQ in 1921 when he was 17. He worked as an RCA radio technician while studying engineering. Following work in radar development during World War II at ITT and Raytheon, he went on to work at Fairchild, General Dynamics, and Lockheed. He holds 32 patents and has had five articles published in technical journals.

Next Time: Part II Demodulator Details

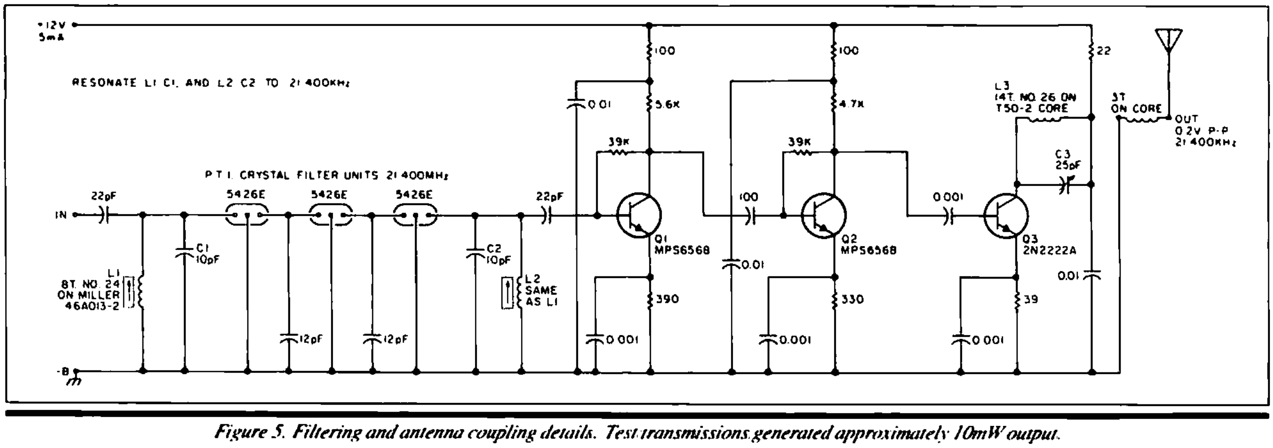
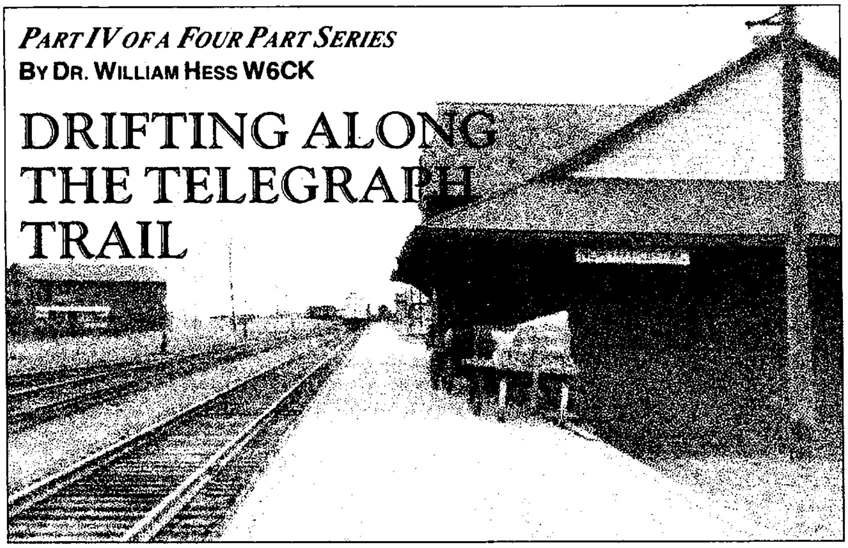


Figure 5. Filtering and antenna coupling details. Test transmissions generated approximately 10mW output.

Part IV of a Four Part Series

By Dr. William Hess W6CK

DRIFTING ALONG THE TELEGRAPH TRAIL



Memoirs of a Former Telegrapher

The Dodge Institute of Telegraphy located in Valparaiso, Indiana, was established early in this century. The Institute primarily trained American Morse operators for employment by railroads; however, most of the operators employed by Western Union and Postal Telegraph were "home-grown" right on the premises. These 14-year-olds were employed as messengers and would practice American Morse on some available "pony" wire while waiting for a new batch of messages to deliver. They eagerly looked forward to working in the steam-heated world of the Morse Operator instead of pedaling their bikes out in the rain, snow and cold delivering messages.

Western Union messengers who brought a sufficient number of replys to messages delivered, were given a new bicycle as an award.

One routine death message to be delivered read:

"YOUR FATHER IS DEAD STOP COME AT ONCE"

By coincidence, the son to whom the telegram was addressed had also died on almost the same day as his father. The persistent messenger, who could already visualize himself on the new bike, would not leave the gathering following the funeral of the son until he had been given a reply telegram. Finally, the mourners composed this gem:

"I CANT COME STOP I IS DEAD TOO"

Dodge Institute

Poor farm boys looked upon telegraphy as about the only available means to avoid spending the rest of their lives walking between the handles of a plow on the farm. High school graduation was not necessary for entrance into the Dodge Institute.

Professor G.M. Dodge's Pierce Arrow Sedan, which could be seen parked in front of the Institute, was a definite clue that the Professor wasn't "hurting" financially. Such a vehicle cost five thousand dollars in 1925, equivalant to $25,000 in today's "cheap" dollars. Older readers will remember the distinctive headlights of the Pierce Arrow automobiles, which seemed to "grow" right out of the front fenders.

The telegraph wires of all three railroads operating through Valparaiso were routed through the dormitories of the Institute. The clicking of telegraph sounders was heard twenty four hours a day, no doubt the first use of sleep learning by anyone, anywhere.

The well trained graduates of the Dodge Institute, all of whom used the code commercially, never forgot how to read Morse code, even if they lived to be a hundred years old.

Later, when jobs for radio operators aboard ships and at shore stations became available, the school changed its name to Dodge Institute of Radio and Telegraphy, erected its own radio station and of course began teaching International Morse code and radio theory in addition to American Morse. During World War II, it trained hundreds of radio operators for the Armed Services.

The buildings are now part of Valparaiso University. During the fifty years the Institute was in operation, five large letters comprising the word DODGE were fastened over the doorway to the Main Building. When the school closed its doors forever and these letters were removed, the lack of sunlight behind them for half a century had indelibly etched the word "Dodge" into the stone building and that is the only trace left today of a school dear to the hearts of many a landline or radio telegrapher. Inquires relative to the Dodge Institute at Valparaiso University today are apt to be responded to with a blank stare by employees of the latter school.

Switchman Mooney

In 1949, I became acquainted with "Haywire Mac" McClintoc, a writer of short stories concerning railroads. He told me a true story about a boomer switchman named Mooney. He appeared one cold and blustery evening at a railroad switching yard in Chicago. McClintoc was a foreman of one of the switching crews there.

Mooney was in very poor condition. Due to participation in a druken brawl, he had a black eye and deep lacerations in his face. Dental problems were of no concern to him, he had no teeth. His clothes were ragged and his shoes had large holes completely through the soles. Nevertheless, the yardmaster was in need of switchmen, so Mooney was hired. He began work on the so-called "graveyard" shift beginning at midnight. Mooney immediately started cutting out cardboard soles for his shoes, utilizing the narrow switch-list forms available in the yard office. These forms were printed on a rather tough type of thin cardboard. The temperature that evening was ten below zero.

All went well throughout the night in switching cars, although a stop had to be made occasionally while Mooney half-soled his shoes with new pieces of carboard. However, at 5 AM, Mooney flashed a violent "wash-out" (stop) sign with his electric lantern to the rest of the crew. As foreman, McClintoc walked the length of a long string of box cars to determine the cause of this emergency signal and discovered that they had run over a hobo, completely severing the body. On the hobo's feet were a brand new pair of leather boots. Mooney was instructed to remain with the corpse while McClintoc went to the yard office to call the police and the coroner. When the latter arrived at the scene, he concluded that the case was a rather simple one, declaring that the hobo probably thought he was boarding a trian for warmer climes and had slipped on the abundant ice present in the yard and thus fell under one of the moving cars. The coroner then added one statement on his assessment of the accident and said "There's one thing I don't understand though and that is what this poor fellow was doing out in this kind of weather without any shoes."

Mac looked over at Mooney and saw that Mooney was wearing a brand new pair of high boots. The Lord works in mysterious ways.

Years later, Mac was walking down State Street in Chicago on a summer afternoon when someone he did not recognize called his name. The man was wearing a completely white suit, patent leather shoes, a Panama hat and a diamond ring with a stone in it about the size of a dime. The "stranger" turned out to be Mooney. Mooney, having had his fill of druken fights, missed meals and shoes with out soles, had turned into a "home guard" (a railroad man who stays on the same job for a long time) and accumulated many years of seniority.

A further postscript to this story is that at the time of my conversation with Mr. McClintoc, NBC Television had a weekly program featuring a different song writer each week. The writer would sing and play his more popular "hits" and explain how he happened to compose each song and so on.

I was struck by the extreme modesty of Haywire Mac in not mentioning to me, during our long visit, that he was a successful composer of popular songs.

Briefly Speaking: RS-232C

Understand what this term really means.

by W. Max Adams W5PFG

Contrary to popular belief, RS-232C is not a physical unit of electronic equipment. It is the Electronic Industries Association (EIA) *designation* of a standard means for interconnecting digital equipment. "RS-232C" is an accepted "buzzword" which, like "Zeerocks" and "Clean-x," has a more lengthy name that completely describes EIA's recommendations. It is "Interface Between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange." RS-232C is a much easier verbal mnemonic to cope with than IBDTEDCE-ESBDI!

The category Digital Equipment has two subcategories: Data Terminal Equipment (DTE), and, Data Communication Equipment (DCE). DTE is a machine that originates and/or receives digital data, such as a computer. DCE is a machine that provides functions to establish, maintain, condition and terminate digital data signals for transmission to another machine, such as a telephone modem or packet-radio Terminal Node Controller. The physical (hard-wired) connection (interface) between most of today's equipment is according to the popular Electronics Industries Association (EIA) RS-232C specification.

The EIA RS-232C standard defines four areas of data equipment interfacing:

1. Mechanical characteristics of the interface.
2. Electrical signals of the interface.
3. Signal functions.
4. Secondary functions for some applications.

The first three areas of the RS-232C specification are those of primary interest to the amateur radio or computer enthusiast.

The EIA RS-232C mechanical standard specifies:

1. Assignment of signals to connector pins.

PIN NO.	EIA CKT	SIGNAL DESCRIPTION	TYPICAL MNEMONIC	FROM DCE	TO DTE
1	AA	PROTECTIVE (FRAME) GROUND	GND	*	*
2	BA	TRANSMIT DATA	TD		*
3	BB	RECEIVE DATA	RD	*	
4	CA	REQUEST TO SEND	RTS		*
5	CB	CLEAR TO SEND	CTS	*	
6	CC	DATA SET READY	DSR	*	
7	AB	SIGNAL GROUND	SG	*	*
8	CF	RECEIVE LINE SIGNAL DETECTED	DCD	*	
9		RESERVED			
10		RESERVED			
11		UNASSIGNED			
12	SCF	SECONDARY RX LINE SIGNAL DET.		*	
13	SCB	SECONDARY CLEAR TO SEND		*	
14	SCA	SECONDARY TRANSMIT DATA			*
15	DB	TRANSMIT SIGNAL ELEMENT TIMING (DCE)		*	
16	SBB	SECONDARY RECEIVE DATA		*	
17	DD	RECEIVE SIGNAL ELEMENT TIMING		*	
18		UNASSIGNED			
19	SCA	SECONDARY REQUEST TO SEND			*
20	CD	DATA TERMINAL READY			*
21	CG	SIGNAL QUALITY DETECTOR		*	
22	CE	RING INDICATOR		*	
23	CI	DATA SIGNAL RATE SELECTOR (DTE)			*
24	DA	TRANSMIT SIGNAL ELEMENT TIMING (DTE)			*
25		UNASSIGNED			

232REV (880123)

Table 1. EIA RS-232C Mechanical standard pin-out designations and applications.

2. Female pins in the DCE connector.
3. Male pins in the DTE connector.
4. Maximum cable length of 50 feet.
5. Maximum cable capacitance of 2500 picofarads.

RS-232C standard input/output (I/O) connectors are commonly called "serial ports" where data bits are "shipped" in and out, one bit after the other. Baud rate (number of signal events per second), signal voltage (or current in some applications), and protocol (responses to data) in digital communication must be the same, thereby allowing individual data machines to understand each other.

One of the most often cussed and discussed RS-232C subject is its signal characteristics and functions. RS-232C was written to standardize telephone (wire line) interfacing. Its original application has been carried over into many other digital communication systems. Some RS-232C features are therefore not presently used. For example, "Ring Indication" is not required for packet-radio equipment interfacing. Table 1 lists RS-232C standard mechanical (pin-out), EIA circuit designation, signal description, common mnemonic and typical DCE/DTE application.

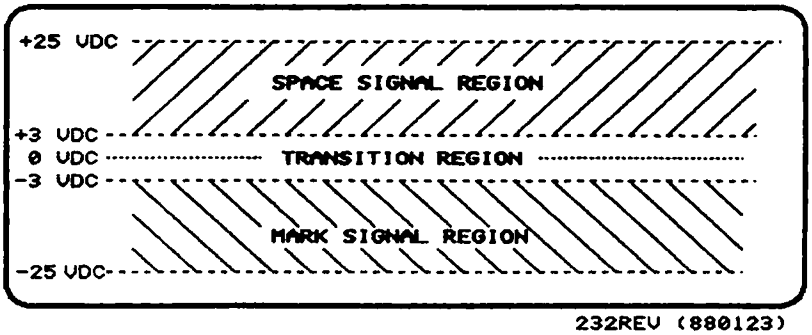


Figure 1. EIA RS-232C Receiver signal levels.

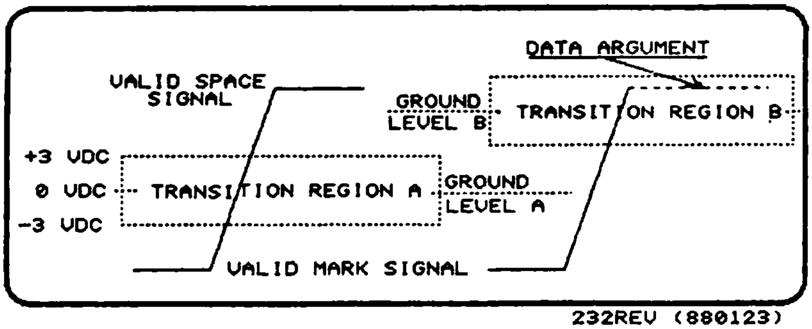


Figure 2. Unbalanced RS-232C ground signal conditions.

Connections

RS-232C mechanical standard is often misunderstood. For example, a DB-25 type connector isn't specified by RS-232C. It became a *de facto* "standard" because of its popular use. RS-232C pins one through seven (and Pin 20) are of major interest in amateur radio applications. Only four of these, however, are required in amateur packet-radio equipment interfacing: protective Ground (GND, Pin 1), Transmit Data (TD, pin 2) from DTE to DCE, Receive Data (RD, pin 3) from DCE to DTE, and Signal Ground (SG, pin 7).

Data signal voltage levels, according to the RS-232C standard, are shown in Figure 1. Negative signals between −3 volts and −25 volts are recognized as Mark signal conditions, and voltages between +3 volts and +25 volts are recognized as Space signal conditions. Mark and Space voltage levels do not have to be the same. For example, Mark signal voltage can be −5 VDC, and Space signal voltage can be +12 VDC. (Note: Mark and Space cannot be generally defined as "logic Zero" or "logic One" signals, or vice-versa, since this relationship is a function of each individual electronic system). Other readily available voltage levels can (and are) used, but often require "conditioning" to *safely* interface with other equipment. Signal voltages cannot reside in the Signal Transition Region and must be within their limits beyond the transition region.

Signal Ground (Pin 7) is common to both transmit data (TD) and receive data (RD) lines, which often results in a major disadvantage of RS-232C application. For example, consider a computer and modem using RS-232C signal level interface. Each unit, operated from its own DC power supply, can cause different reference (power and signal) ground levels at each end of the interface cable, as shown in Figure 2. Data between equipment with different reference levels can be "misunderstood," thereby resulting in program or information "glitches."

RS-232C standard signal current is specified to a level that will not burn up interfaced equipment due to faulty or improperly connected cables or connectors. The equipment can be damaged, but should not "smoke!" (In electronics, never say "never." Mr. Murphy's well-known laws often puts egg on one's face.)

Ham Shack Analogy

Using an RS-232C interface is somewhat like using a radio transceiver to interface with another ham radio station. The receiver is patched to the data source station transmitter, and the transmitter is patched to the destination station receiver. Both source and destination equipment "parameters" (i.e., frequency, communication mode, communication protocol, etc.) must be the same for mutual understanding. RS-232C does not specify baud rates, communication mode, or communication protocol.

RS-232C does, however, provide flexible equipment interfacing and some interesting discussions on your local repeater!

Briefly speaking, the primary purpose of EIA's RS-232C standard is a reference for system design. Manufacturing considerations produce a wide variety of connectors, special signals and voltage/current levels. Hopefully, the equipment manufacturer provided documentation to aid the user.

The functions of RS-232C standard signals are well documented.

Pin 1—PROTECTIVE GROUND.

Pin 2—TRANSMIT DATA (TD). Connect it to a receive INPUT.

Pin 3—RECEIVE DATA (RD). Connect it to a transmit OUTPUT.

Pin 4—REQUEST TO SEND (RTS). A signal from the data source that tells the associated (receiving) device it (the source) has data to be transmitted.

Pin 5—CLEAR TO SEND (CTS). A signal from the associated receiving equipment to the data source (transmit) equipment, it (the receiver) is ready to accept data input.

Pin 6—DATA SET READY (DSR). DSR is "asserted" (made available) on PIN 20, when the equipment is operational and ready to transmit and/or receive data. DTR (and DSR), in some applications, are jumpered at the cable connector and not physically connected to other equipment.

Pin 7—SIGNAL GROUND (SG). This is *not* the same as pin 1. Pin 7 is the "return" path that Mr. Ohm requires.

When all else fails, look at the reference material in the bibliography. It may well allow the reader to come up with the seventh answer to a six-way-QSO RS-232C question on your local repeater, or at the next brown-watering hole (coffee shop) QRM session.

1. *ARRL, "AX.25 Amateur Packet-Radio Link-layer Protocol, Version 2.0", October 1984.*
2. *Lyle Johnson WA7GXD, "Join the Packet-Radio Revolution, Parts I, II and III",* 73 Magazine, *Sept/Oct 1983, January 1984.*
3. *Margaret Morrison KV7D, et al. "Amateur Packet-Radio, Parts 1 and 2", Ham Radio, July/August 1983.*
4. *W. Max Adams W5PFG, "Briefly Speaking, Basic Amateur Radio Packet Radio",* CQ Magazine, *November 1985.*
5. *Radio Shack No. 62-1388, "Understanding Telephone Electronics".*
6. *Radio Shack No. 62-1389, "Understanding Data Communications".*
7. *Radio Shack No. 62-2010, "Understanding Digital Electronics".*

Bicycle-Mobile R & D Lab

Practical Points for Inhibited Experimenters

by Steven K. Roberts N4RVE

It can happen anywhere, and usually does. I wake in camp, breathe the vapors of morning inside a billowing nylon cocoon, rustle a warm hand from the depths of my sleeping bag to touch KA8ZYW, and lie there thinking intently. "Hmmmm...if I let the new TNC handle speech control in parallel with the BCP, then I can sign on via packet from the HP and carry on a synthesized conversation with people around the bike...monitoring their audio on 49 MHz. Gee..."

Maggie's hair cascades across my neck. "You were talking in your sleep again," she murmurs. "Is a speech-control bus something the government uses to arrest boring politicians?"

Those are the first clues. Over flawless campground coffee, I stretch, sketch, and mumble, scan my listings and schematics, regale the morning-sweet YL with complex tales of logic and technomagic. The maps are forgotten and there's no rush to pack...for it's a tinkering day!

Well, so now what? There's no room on a bicycle for diagnostic tools, documentation library, R & D inventory, prototyping board, and drafting equipment—or is there?

One of the things I've learned from this whole traveling circuit of mine is that no complex system is ever finished. And while reliability has been generally excellent, I find a lot of reasons to crawl under the hood and do some engineering. As such, I've had to put together a passable mobile R & D lab...and in this, the fifth column of the series, I'd like to take the reader on a quick tour.

The First Issue: Documentation

If I had to work on the Winnebiko from memory, nothing would ever get done for fear of screwing it up beyond recognition. A project in progress becomes etched so deeply in the brain that the builder is sure he always remember exactly how it works. A few grim all-nighters of staring glumly at undocumented creations, however, dispelled that fallacious notion from my head. I now carry three forms of documentation on the bike:

A clamp-style binder, stuffed with about ¾" of schematics, listings, notes, wiring specs, idea sketches, and so on. This is the irreplaceable document that completely defines the custom parts of the electronics package, and I periodically photocopy the whole mess and mail it back to my office as a backup.

An "aquarium of microfiche" containing highly reduced copies of key IC databooks, software and hardware manuals, reference guides, and so on. A 20X Keyan reader gives easy access to what would otherwise amount to 15–20 pounds of books. I have also added Buckmaster's microfiched amateur radio call directory, a number of maps, and other convenient reference material.

A subdirectory of disk files on the HP laptop, defining operating procedures, the functions of all controls, and other variable information. This includes the Bicycle Control Processor's source code listings and—equally important—a sprawling file of comments and narrative explanations associated with each of the 15 major revision levels. This has proved invaluable time and again, as I wade hesitantly into an obscure backwater of this real-time program and wonder what madness possessed me back when I wrote it.

Adding new documentation is something that should happen at the time of any change to the system, of course, so my "R & D pack" also contains a small case with basic drawing tools and templates.

Tiny Test Bench

With space at a premium, I had to forego a few basic essentials. I carry no oscilloscope, function generator, spectrum analyzer, hammer, or milling machine. But I do have a logic probe, digital multimeter, SWR bridge, prototyping board, software development system, bench supply, built-in current monitor, "Quick-Connect" wiring tool, butane soldering iron, and extensive toolkit.

It's amazing how much can be done with a few basic lightweight tools when the constraints of a nomadic lifestyle demand it. My software contains a library of test loops that exercise all I/O logic in a way that makes it amenable to debugging with a logic probe and development system. Internal jacks offer convenient supply voltages for prototyping, and a ledge inside the console even carries a permanent parts tray and soldering-iron stand. The point of all this, of course, is to make development work as painless as possible...even if it happens in a campground.

Easy prototyping depends upon a convenient packaging method, and I use the Robinson-Nugent Quick-Connect boards exclusively. They're faster than wirewrap, lower profile, and more rugged (a major issue on a bicycle). The boards are hinged in my installation, so modifications can be made without having to unplug any connectors or dangle live hardware from a cable harness.

One more thing. Despite convenient onboard equipment, there are still occasional projects that require more in the way of support facilities than I can carry. I keep a list of such "long-range TO-DO's" on disk, and scan it whenever I find myself visiting someone who owns a well-equipped lab. "Ahhhh...I see you have a spectrum analyzer. You know, I have some birdies that have been giving me trouble...got a near-field probe for that thing?"

The Junk Box

As we all know, no lab is complete—or even possible—without a well-equipped junk box of tinkering stock. It's just not possible to experiment effectively if the only access to components is a shopping list (hamfests and surplus stores notwithstanding).

I carry about six pounds of parts, as well as a bag of fundamental essentials such as Ty-raps, wire, heat-shrink, and the like. There is a sheet of antistatic foam with a hundred or so 74HC glue parts, along with a collection of particularly interesting devices I just gotta have. (You know how it is: "Well, someday I'll find a neat use for a high-speed array processor on my bike...sure, I'll take it.") There are a few dozen individual Zip-Loc bags, dedicated to such things as R's, C's, D's, Q's, connectors, switches, ferrites, packaging parts, mechanical hardware, spade lugs, and so on—with, amazingly, enough depth and variety to support a typical day of tearing into the system with new ideas in mind.

Keep On Tinkerin'

The bottom line, of course, is that no-one need be prevented from experimenting by the constraints of a nomadic, cramped, or socially hampered lifestyle. I have an old friend who lost the spark of tekwizardry when he married a rather dull preppie more obsessed with style than substance. The books in the living room were sorted by color of binding, the dog was a designer model far beyond their budget, and all that junk of his cluttering the basement JUST HAD TO GO! Before long he gave in: The subscriptions to journals lapsed, the equipment was all sold or given away, and this promising designer of early microprocessor systems became just another dull employee with no passions, no hobbies, no energy, no dreams.

But a single desk can hold enough to keep the creative spark alive—enough to keep the nose wrinkling with the acrid smell of solder...the eyes gleaming in the light of dancing phosphor...the ears perking to the distant call of an unmet friend as yet another idea survives the smoke test and reinforces the reason for being.

Creativity can thrive anywhere—let it!

Continued from page 6

Island, Oahu, Calfornia, Missouri...and back to New Jersey. It was a fantasic six week trip, meeting hams at every stop and talking with thousands more while we were flying. Unfortunately, I was so irritated by OLJ's arrogance that I refused to write the story of the trip.

Where was I?

Now, Chandra...Well, on the strength of the article in the March *Discover*, I bought her book, *Evolution From Space*, a theory of cosmic creationism, written with Sir Fred Hoyle. Chandra, it turns out, is a well-known astronomer.

The book was utterly fascinating. I couldn't put it down. Chandra does a very scientific job of lining up all of the facts available from astronomy, geology, biology, and other sciences, and presents them as a completely new concept of how life started and developed on Earth. No, the ideas are not supportive of biblical creationism, nor of Darwin, for that matter. She makes a powerful case, carefully documented every inch of the way. Most impressive.

Particularly fascinating to religious zealots may be the problem of their cherished beliefs being challenged by science. Of course, that's supposing such a transformation is possible, which I don't accept. Religious, like political beliefs, often are remarkably durable, able to withstand incredible onslaughts of reason and facts with nothing more lasting than deep resentment resulting.

Unconventional Wisdom

While on the one hand Chandra demolishes all the accepted explanations of how life began on Earth, she comes up with both a mathematical and a scientific proof of the existence of God. Scientists who haven't had a religious brainwashing may find this irresistable.

For instance, Chandra shows clear evidence that life occurred on Earth at the earliest instant it could have survived here. She shows mathematically the utter impossibility of life getting started by chance. If you feel like arguing with her theory, read the book ($5.95 in paperback), don't get steamed up just from this microreport.

She shows that microbes are small enough to be pushed through space millions of light years by the pressure of light. She shows that they can live for billions of years in suspended animation, awaiting a suitable planet to colonize. She shows that there seem to be vast quantities of such cells moving through space.

I suspect Chandra's book may appeal to people in an inverse proportion to the degree of religious brainwashing they've received, mostly from parents when they're very young. "Give me a child until he's seven and I'll give you the man." Was it Freud who said that? If you watched the PBS program "7-14-21-28," you probably understand the startling truth of this concept.

Brain Power

Now, this brainwashing thing takes me back even before my exciting adventures on Operation World-Wide. We've all seen the Hari Krishnas at airports and read about Moonies, so we know on some level that brainwashing works terrifyingly well. We may think that there's a requirement for some sort of brain damage or stupidity to make someone susceptible to these religions.

No, it can happen to the most intelligent people. It's got little to do with intelligence or education. It has more to do with hypnotism, which is a mysterious working of the mind only a few people understand. For that matter, it's not really possible to say that anyone really understands how the mind works. Heck, we still don't even have a clue as to where or how memories are stored.

Anyway, quite a few years back there was a chap who came out with an outrageous explanation of how the mind worked. This, in turn, suggested a way to repair some of the more serious mental problems. Naturally the medical establishment quickly branded him as a quack, the same treatment they give almost anyone with a new idea, right or wrong. But I'm willing to give new ideas a chance, so I read carefully on the subject. Then, fascinated by what I'd read, plus some very convincing experimental proof, I left my job as a radio engineer/announcer and went to work with the chap for a while in his new research foundation.

One of the beauties of brainwashing with hypnotism is that the people hypnotized not only are unaware that anything strange has happened, they will fight to the death for their new beliefs. This is why it is so difficult to kidnap and reprogram people who have been captured by the fanatical religious sects. This is one of the reasons why we have terrorists. You just can't reason with such deeply ingrained mind programming.

So What?

In general I've found that the louder and the more impassioned the noise from politicians and religious leaders, the less I'll find of truth and the more I'll be expected to accept beliefs on blind faith.

How can we tell when we are reacting because of brainwashing or hypnosis? Heck, that's easy, if you think about it. The flashing red light should come on when you find yourself getting mad. This is a class A warning that reason is fighting some sort of belief. The easy way out is to get mad. This blanks the mind from receiving any further reasoned input. When you get mad you are no longer able to think rationally. Just listen to angry people screaming out slogans. Many things they say don't even fit the occasion, but their conscious mind is so heavily blanked by angry emotions that they aren't even aware of all this.

The Impossible Is Possible

It's frustrating to realize that all of us are, to some degree, operating on the basis of early brainwashing. We're embarrassed at the thorough job our ancestors did on the American Indians. Could never happen again, right? Then we think about the job the Germans did on people not all that long ago. They killed about six million Jews and another six million non-Jews. Stalin wiped out over double that. The Chinese wiped out tens of millions fairly recently. 600,000 Ugandans have been murdered in the last few years. Several million Afghanis. Who knows how many Iranians and Iraquis?

The people who are doing all this killing are people. People like us. The only difference is in the degree and type of brainwashing. Old timers like me will remember the force of patriotism that fueled WWII. There was little thought of not fighting. Men were caught up in it, pushed hard by their wives and mothers. The media and Hollywood cooperated with the government in massive media hype. It worked.

It's fascinating to demonstrate the power of even the simplest of post-hypnotic suggestion. For instance, if you tell a person under hypnosis that when you touch your cuff he'll take off his coat and when you touch your ear he'll put it back on, you can have him taking off and putting on his coat dozens of times, always with a logical (to him) explanation, one he truly believes. It isn't until you have him taking it off and putting it on several times a minute that he finally realizes something is wrong that he can't explain. It's absolutely amazing how well even a simple exercise like this is protected by the mind from recognition.

Yes, with the appropriate therapy it's possible to go back and decondition all this mess, setting people free to actually think. This must take a long time, right? No, it's incredibly faster than any of our accepted mental therapies. We're talking about months of cure in hours.

Lamentation

I bump into Bud at Dayton occasionally. I haven't seen W8OLJ since the trip, thankfully. It would have been an infinitely better trip except for him. Bill W2SKE was a great traveling companion. He went on to become the head of CBS News and retired a few years ago.

I'll have to write about the trip. I don't remember that anything like it has ever happened again in amateur radio. It was a ham's idea of nirvana, visiting 24 countries, all the while keeping in touch with the entire world with the ham station on the C-54.

Old timers will remember when Arthur Godfrey went on a trip to Africa and took along amateur radio. I remember trying my darndest to get through when he was on the air from French West Africa (FF8)—not to talk with Arthur, but with a close friend of mine, Carol Cone, who was along with him on the safari. Never made it.

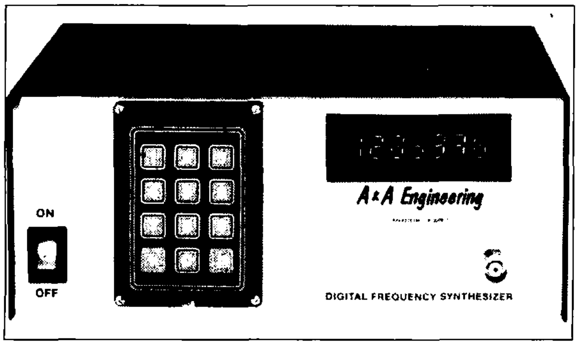
Somewhere in the barn I have a couple of the old Operation World-Wide Ampex tapes. I wonder what ever happened to the dozens of tapes with the thousands of OSOs from that trip?

Ah, a lament for the old DXpedition days: the Hallicrafters DXpedition into darkest Africa; Godfrey; Don Miller, for all his shenanigans, gave us contacts from almost everywhere. Gus Browning W4BPD's trips; Danny Weil and the YASME; Dick McKircher W0MLY's African barrage.

Say, where are Lloyd and Iris now?

NEW PRODUCTS

Compiled by Linda Reneau

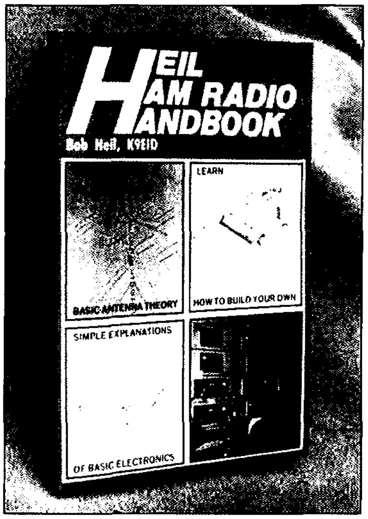


PRODUCT OF THE MONTH

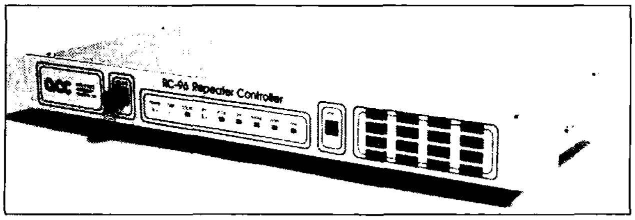
A & A ENGINEERING

A & A Engineering's new Digital Frequency Synthesizer has 1 Hz resolution, an output of ½V peak-to-peak into 75Ω with almost no phase noise to frequencies in excess of 6.5 MHz. Digital synthesis techniques elimate VCO, PLL, and loop setting time. It comes complete with RF unit, microprocessor controller, seven segment display, keyboard, and 110 VAC power supply. The controller offers a standard 12-key program and accepts as many as 32 keys. Unused EPROM and RAM space allows the user to program custom features. The price is $429.95 per unit, FOB Anaheim. Quantity discounts. Call or write *A & A Engineering, 2521 W. La Palma, Unit K, Anaheim CA 92801; 714-952-2114.* Or circle Reader Service number 211.

MELCO PUBLISHING

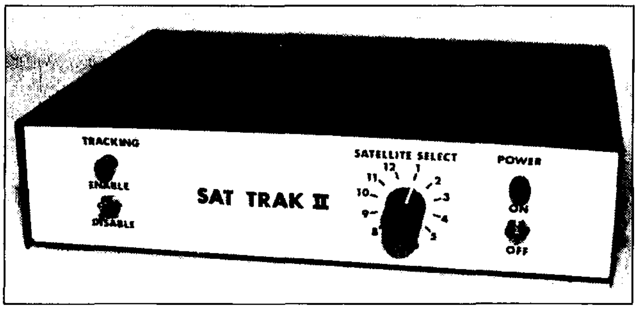


The *Heil Ham Radio Handbook*, written by Bob Heil K9EID explores the practical aspects of installing antennas, soldering connectors, grounding your station, identifying transitor leads, and much more. This book has lots of handy hints and money-saving ideas in easy to understand language. To order, send $9.95 plus $1 postage to *Melco Publishing, PO Box 26, Marissa IL 62257.* Or circle Reader Service number 202.



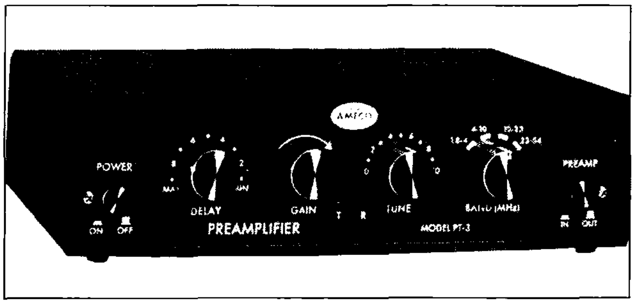
ADVANCED COMPUTER CONTROLS, INC.

The new RC-96 Repeater Controller has remote programming, autopatch with autodialer, and memory for 200 phone numbers. It also features a talking S-meter, built-in keypad and shielded DIN cables. The RC-96 Repeater Controller supports pocket pagers, linking to other repeaters, and a bulletin board. A gas discharge tube across the phone line and transient suppressors on each signal line minimize the risk of lightning damage. The suggested retail price is $1,350. For more information, contact *Advanced Computer Controls, Inc., 2356 Walsh Avenue, Santa Clara CA 95051, or call 408-727-3330.*



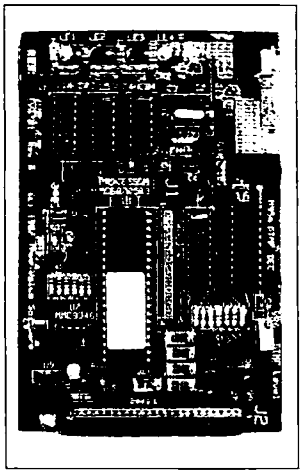
APPLIED DIGITAL RESEARCH, INC.

ADR announces SAT TRAK II, an automatic satellite tracking controller. SAT TRAK II calculates satellite position and antenna angle in real time. It will drive most azimuth and elevation rotors including the Kenpro KR400/KR500, KR5400A, KR5600A (an interface is provided for the "A" series), and CDE rotors. The $435 price includes all necessary connectors and a 110 VAC power supply. *Applied Digital Research, Inc., PO Box 10184, Sarasota FL 34232; 813-378-3410.* Or circle Reader Service number 201.



AMECO PUBLISHING CORP.

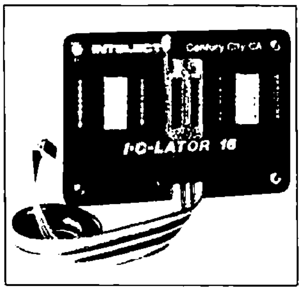
AMECO's new tunable preamplifier Model PT-3 continuously covers 1.8 through 54 MHz. Options are available for second receiver and separate receiving antennas. Retail, the PT-3 Preamplifier is $109.95. The P-12T power supply adapter is $8.95. For further information, contact *AMECO, 220 E. Jericho Turnpike, Mineola NY 11501; 516-741-5030.* Or circle Reader Service number 214.



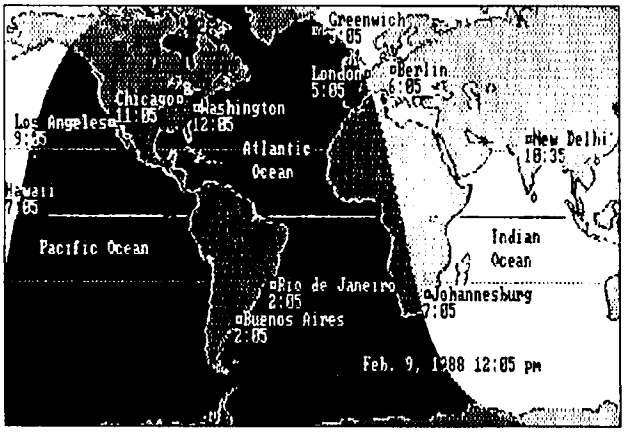
TRUE VALUE SOFTWARE

True Value Software TVS701B repeater controller can be remotely configured without ROMS or jumpers. The unit offers voltage telemetry and alarms to monitor batteries and power levels. A watchdog timer and EEPROM protect the unit from power failure. TVS701B has 74 functions, four levels of control security, digital inputs and outputs for auxiliary control and alarms. Easy-to-build kit price: $190. Assembled and tested, $300. *True Value Software, 2805 E. Sherran Lane, Phoenix AZ 85016; 602-956-4259.* Or circle Reader Service number 204.

INTELECT

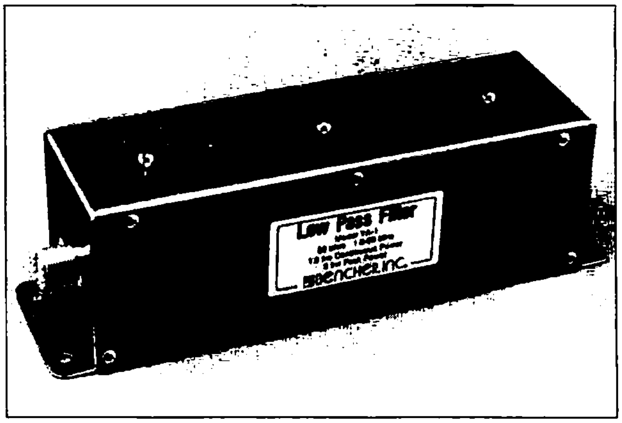


The I-C-LATOR 16, available from Intelect, allows design and test of any DIP device. The user can open loops, inject signals, and modify circuits outside an original assembly. The experimenter can measure current and independently open each signal path. The user replaces the original IC with the I-C-LATOR 16's cable, elminating the need for card extenders. The unit will accommodate 6- to 16-pin analog or digital ICs. It can be used with emulator probes, function generators, logic analyzers, and scopes. Price: $49.75. Free brochure. INTELECT, 2908 Nebraska Ave., Suite A, Santa Monica CA 90404. *Or circle Reader Service number 203.*



TRIDOS

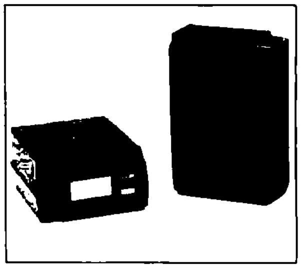
Terminator, from TriDos Software Publishers, is a real time graphic emulation of the Geochron™ clocks. The graphic map of the earth shows the terminator line between night and day. The time algorithms consider solar declination, apparent size of the solar disk, atmospheric refraction, and the difference between solar and earth times due to the earth's slightly elliptical orbit. To display areas on the map add the user's name, longitude, latitude, and time zone to the parameter file. Terminator is available from dealers for $39.95 or from *Spite Software, 4004 SW Barbur Blvd., Portland OR 97201. Order toll free at 800-237-9111.* Or circle Reader Service number 210.



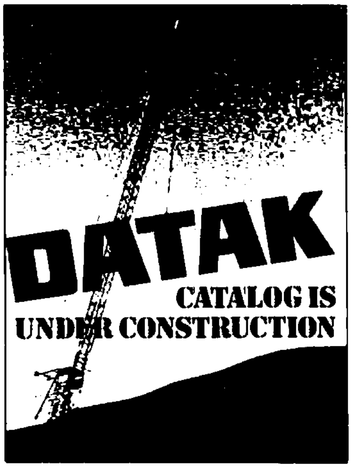
BENCHER, INC.

Bencher introduces the YA-1 Low Pass Filter, which demonstrates a minimum attenuation of 80 dB for harmonic radiation at 54 MHz. It has a working range of 1.8 to 29.7 MHz, an impedance of 50Ω, power rating of 1.5kW continuous, and 5kW peak. The YA-1 sells for $39.95 plus $3 postage. *Bencher, Inc., 333 West Lake Street, Chicago IL 60606. MCI Mail 277-5159, TELEX 650-277-5159, Phone 312-263-1808.* Or circle Reader Service number 215.

PERIPHEX, INC.



Periphex announces new replacement battery packs for the Yaesu FT-23/R/33R/73R. The FNB-10, 7.2V 600mA for 2.5W output and the FNB-12, 12V 500mA for 5W output are both available from stock. Charge with standard Yaesu wall or desk chargers. Both battery packs offer a one year guarantee. FNB-10 is just $33, and the FNB-12 is $49 + $3 shipping. For further information on these or other battery packs, contact *Periphex, Inc., 149 Palmer Road, Southbury CT 06488; 1-800-634-8132, in CT 203-264-3985.* Or circle Reader Service number 205.

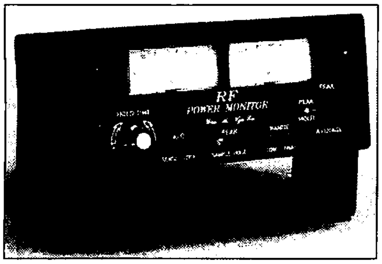


DATAK

DATAK's latest 30-page catalog is for the ham who builds or customizes his own gear. The catalog offers electronic title sets; multi-color transfer designs to make special meter dials and tap switch patterns; alphabet and number sheets; resist patterns for making printed circuits via the "Direct Etch" method; and a patented "Photo Etch" set that will copy circuit patterns from a magazine without harming the page. DATAK also has over 600 JotDraft™ printed circuit patterns, PC tapes, etching and plating chemicals, and protective coatings. For your free catalog write to *The DATAK Corporation, 3117 Paterson Plank Road, No. Bergen NJ 07047.* Or circle Reader Service number 213.

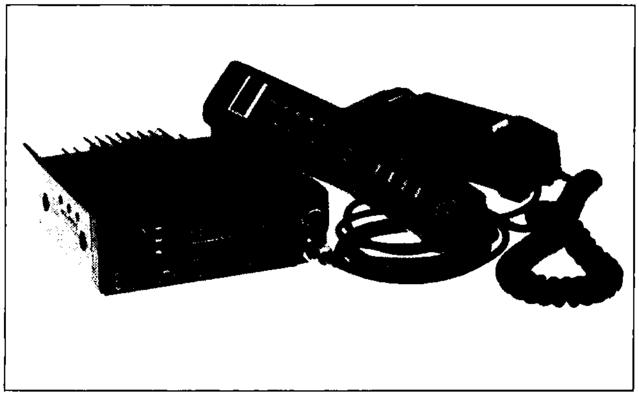
AMATEUR RADIO SCHOOL

Amateur Radio School announces their newest course, the Video Novice. Using your TV and VCR, this course demonstrates subjects not easily understood from books alone. Video Novice covers practical demonstrations and explanations for everyone new to amateur radio. The course consists of two, two hour VHS cassettes, one C90 audio cassette, and a study guide with 302 questions, answers, and a frequency chart. Cassette #1 has two hours of theory, and #2 has one hour of theory and one hour of visual code instruction. The Video Novice Course is $39.95 plus $5 postage. To order or for more information, write or call *Jerry Ziliak KB6MT, Amateur Radio School, 2350 Rosalia Drive, Fullerton CA 92635. 714-990-8442.* Or circle Reader Service number 206.



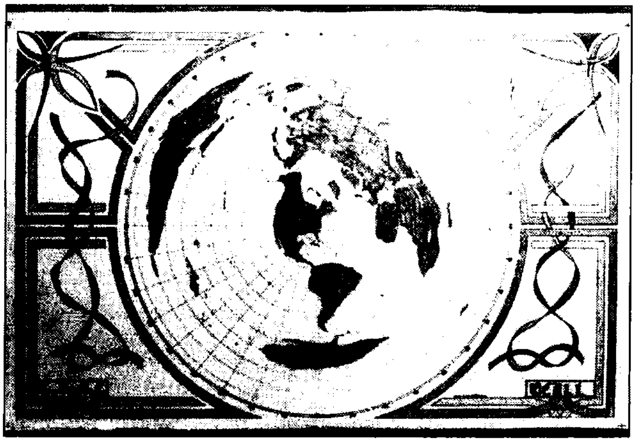
WM.M. NYE COMPANY

The NYE RF Power Monitor gives peak, average or peak-and-hold readings using a sample-and-hold analog memory circuit. The monitor can display the correct peak power reading of a single 1 msec pulse for up to 20 seconds. Other features include adjustable ALO, automatic SWR, interchangeable couplers, SWR/REV warning display, NiCd batteries with a separate charger, and full-wave detection system. Rated up to five kilowatts, the RFM-003 and the RFM-005 differ only in wattmeter scaling. Priced at $297. Contact *Wm. M. Nye Co., 1614 130th Ave. NE, Bellevue WA 98005; 206-454-4524.* Or circle Reader Service number 208.



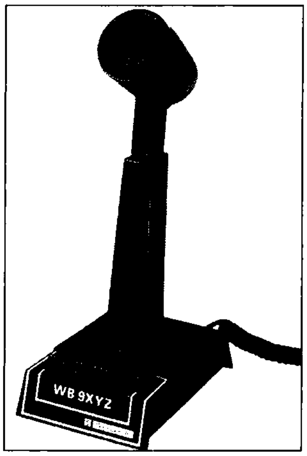
KENWOOD

Kenwood announces the new TM-721A FM dual-band, 2m/70cm mobile transceiver. Features include a dual-channel watch function, selectable full duplex operation, extended frequency coverage with 30 memory channels, large multi-color digital LCD displays, and programmable scanning with 45 watts output on VHF and 35 watts on UHF. Retail, $649.95. For more details, contact *Kenwood USA Corporation, Communications & Test Equipment Group, 2201 E. Dominguez St., Long Beach CA 90810; 213-639-4200. Fax 213-604-4487.*



GREAT CIRCLE MAP COMPANY

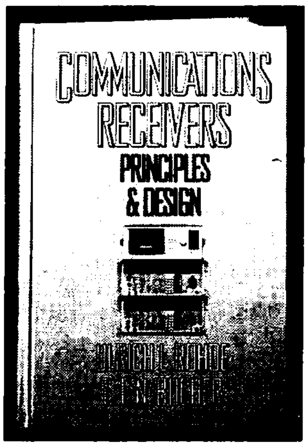
The Great Circle Map Company now has azimuth-equidistant wall maps that give the radio amateur instant information on range and beam headings to any location on earth. Each map is unique, specially drawn using computer techniques, and centered on the individual's QTH. The major surface features are detailed by hand. The station's callsign are hand-lettered on the lower right. Suggested retail, $59. For more information on these brightly colored, 35" x 23" maps, write *The Great Circle Map Company, 8409 Bear Tree Circle, San Antonio TX 78255.* Or circle Reader Service number 209.



SHURE

The Shure 444D Omnidirectional Controlled Magnetic Microphone offers switch selectable impedance, a normal/VOX selector, and Shure's patented leaf switch with locking and momentary action. Frequency response is tailored for optimum speech intelligibility and purchasers can receive a free individually printed plate with their call letters. The suggested retail price is $78. For more information contact *Shure, ATTN: Carolyn Gunnell, 222 Hartrey Ave., Evanston IL 60202; 312-866-2200.* Or circle Reader Service number 212.

McGRAW-HILL BOOK COMPANY



Communications Receivers: Principles and Design, by Ulrich L. Rohde and T.T.N. Bucher, is a guide to the theory and design of all types of communications receivers—shortwave, military, broadcast, aeronautical, marine, and direction-finding. Accessories and peripheral equipment are covered, along with a wide range of design topics and engineering concepts. There are 583 pages with 402 illustrations. Cost is $59.50. *McGraw-Hill Book Company, 11 West 19th Street, New York NY 10011; 212-337-5945 or 337-5951.* Or circle Reader Service number 216.

Number 17 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free, on a space available basis. To make our job easier and to ensure your listing is correct, please type or print your request clearly on a full (8½ x 11) sheet of paper. Double space and use upper and lower case letters where appropriate. Also, write numbers carefully—a 1, for example, can be read as an l or an i or a 7. Thanks.

I am collecting amateur radio license plates from each of the US states and possessions, and the ten provinces and two territories of Canada, for a public display. I am also looking for any information on Amateur radio license plate history, such as which region first started issuing them, when, and if they are issued in countries besides the US and Canada. Finally, I'm interested contacting any other license plate collectors for possibly forming a voice net.

I will gladly pay all photocopying, shipping and handling costs. Thanks!

Bryan Hastings KA1HY/AE
64 Concord St.
Peterborough NH 03458

Looking for front panel, part #205-178-1 for Heath VF-7401 two meter rig. Heath no longer sells that part. Will pay for part and shipping.

Bob Clark N5GSE
5430 Markwood Lane
Houston TX 77053

I need schematic and alignment info for Lafayette Model HA-700 Receiver. I will copy and return. Thanks.

T.W.Brown KA7NIE
5104 E. Farmdale
Mesa AZ 85206

Need conversion info re/Hy-Gain V, Model #2705, 40 channel, SSB, CB transceiver. The board is #PTBM048AOX. It is desired to start Ch. 1 at 28.300 MHz and work up from there. Any information on this conversion would be greatly appreciated. See you on 10.

Edward R. Levy WB3EVY
PO Box 161
Blakeslee PA 18610

Help wanted for information. Cost of copy or dispatch will be gladly refunded. 1) Any information or ECN's for improvement/modifications on the Spectrum Generator and PLL Synthesizer part of National HRO-500 Receiver. 2) Circuit and alignment info of SINGER Electronics Universal Spectrum Analyzer Model MF-5 and Plug-in unit Ultrasonic Module UR-3. 3) Diagram of MFJ 931 Tuner. 4) Technical info and application circuit of TOKO's Mechanical Filter MF 455A 120F with coils 9579A and 9580A. 5) Possibility of adding the 7th digit-display TS-830S.

Fred Olte C30LEN
25C, La Pleta Ordino,
Principat d'Andorra (EUROPE)

Wanted manuals/schematics for G.E.L. Receiver 13B1, A.C.L. Receiver TR140A, G.R. 1617 Cap. Bridge, Waters 1003B Diode-checker, Singer-Gertsch FM9CG SIG. Gen., Motorala S1323 Meter.

W. Kinne
1163 Ingerson Road W.
St. Paul MN 55112

HELP! I'm looking for a schematic or conversion manual if available for a Navy receiver in the RAX-1 Series. It has 4 band coverage from 1.5 MHz to 9 MHz. It's type CG-46116. I'll pay a reasonable price.

Gary Nelson
P.O. Box 3676
Portland ME 04104

Looking for a vanishing breed. I would like to contact for friendly correspondence and mutual assistance any and all who are into collecting, restoring and using the classic receivers—Collins S-Line, 51-J, R-390, SP 600, HROs, etc. Also high grade, useful military surplus.

J.L.Browning
6442 Cathay Cir.
Buena Park CA 90620

I'm looking for schematic of AN/VRC-19 150–160 MHz, mobile, 24-volt FM TX and RX equipment, or data on same.

Richard Thompson
234 Spring St.
Hanover MA 02339

I need an instruction manual and/or schematic for the Hickock 6000 series tube tester. Will pay any copying and mailing costs.

T.H.Killoran W7PP
8316 54th Dr. NE
Marysville WA 98270

Propagation forecaster wanted! *73* needs a new propagation writer, since Jim Gray W1XU plans to take his retirement seriously later this year. Naturally, you should be familiar with modern propagation prediction techniques, though writing experience is not required. Send queries to:

Larry Ledlow NA5E
73 Magazine
Peterborough NH 03458

Digital Voice Compression

Potential for smaller bandwidth

by Charles Opitz WA3YQY

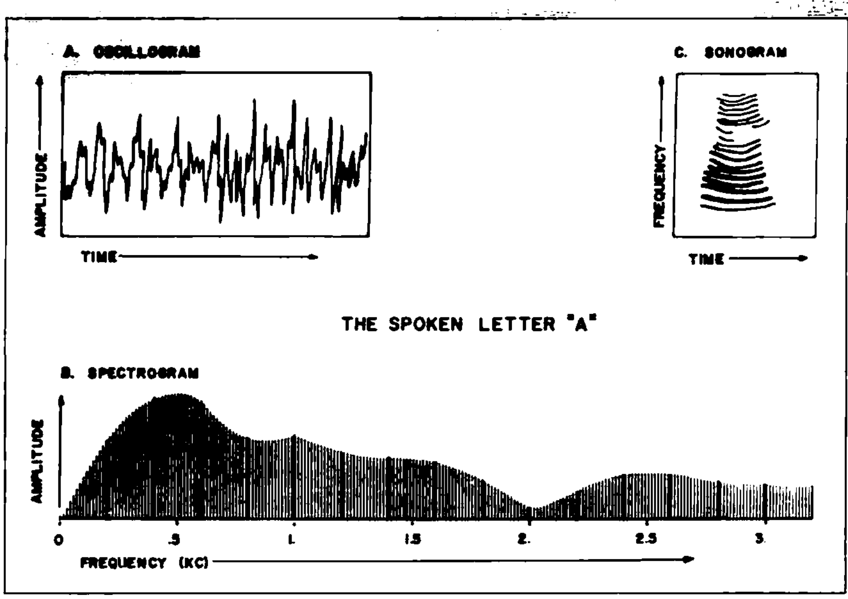


Figure 1. Three different ways to look at a fundamental sound of speech, or phoneme. Note that most of the information is contained below 2 kHz. Future voice compression techniques will probably take advantage of the redundancy of sounds in speech.

Since a good friend of mine recently lost the use of her vocal cords, I have recently given a lot of thought to state-of-the-art speech synthesizers.

One of the primary interests in amateur radio is to obtain the narrowest passband. Voice naturalness is often a secondary concern. Digitizing voice is a sort of "audio teletype," where the transmitter operator's voice is automatically encoded into a lowest possible bit rate for transmission, and where the receiver decodes this message and generates, in more or less real time, an audio version of the input spoken word. The synthesized voice must contain the meaning of the original voice message, and do so with an acceptable low error rate (1–3%).

I predict that regenerated voice will be a standard pitch male voice. (No chauvinism here, but the female voice is much more difficult to synthesize). The new voice will lack subtle cues for emotional state of the speaker. In essence, the generated speech will have just about the information content of an equivalent printed word message, but without the redundancy of spelling of the printed English word.

Note that I say English here, because that will be the language used in any first-generation voice compression system (VCS). All the advance work in speech analysis/synthesis is in English. Also, English has relatively few phonemes, and is becoming the world's lingua franca.

Smaller is Better

When receivers are white-noise limited, the signal-to-noise ratio (S/N) is proportional to narrowness, required transmitter power is inversely proportional to narrowness, and the number of permissible communication channels within a given band is directly proportional to narrowness of the transmissions.

Many have mentioned an ultimate voice transmission bandwidth of 25 Hz. E.C. Cherry, an early English worker in this field, wrote a paper that suggested this number. I have never seen, however, that value rigorously derived, It's possible, though, that it came from removing the redundancy of spelling from printed matter, then using the true information content (bits) and taking the average person word-speaking rate to compute the bit rate. The average ham QSO information rate is more like ½ that rate, but for now this article will work with the 25 bits/second figure.

Since there's no common system on the market today, I believe that a relatively inexpensive commercial device with a bandwidth as wide as 500 Hz would be quite marketable. Think of the expensive and sophisticated equipment hams gladly acquire to cut the required bandpass of AM to one half with SSB! Imagine cutting the SSB signal bandpass again by a factor of ⅛ or just ½.

Figure of Merit

For discussion purposes, here's an attempt to quantify the quality of DVC systems by using a figure-of-merit (FOM). The FOM is referenced to the "ultimate" 25-Hz passband mentioned above. In this score system, the perfect system, which is the one with a 25-Hz passband, gets 100%. Any system with a wider passband gets a lower score. Where BW = system bandwidth in Hz:

$$FOM = 100(25/BW)\%$$

The FOM in dB would be:

$$FOM = 10(\log[25/BW])dB$$

For example, a typical telephone quality link with a bandpass of 250–2800 Hz has a BW of 2550 Hz, in which case, the FOM is only 0.98% or −20 dB regarding the ultimate system.

Please note that for this discussion I assume the permissible bit/second rate is proportional to bandwidth in Hz for simplification purposes. I am aware of Shannons' information theory equations, so in this case let's permit about 1% word error, in which case my assumption is about right for simple pulse modulation with a S/N in the channel of about 15 dB.

Using ultimate VCS system parameters, let's go to the year 2000. The FCC has allocated a 100 kHz slice of the 20-meter phone band to VCS. Rather than allowing 30 simultaneous QSOs with conventional SSB rigs, this band would supporting about 3000 VCS channels and 1 kW transmitters generating the same S/N in receivers that a conventional 100,000 watt SSB transmitter does in an old fashion SSB receiver.

There is one little problem left—how to manufacture a compact, inexpensive 100% FOM VCS? It's impossible to say. I predict, however, that compromised systems in the laboratories today will be seen shortly.

Why Digital Voice?

Many of the early workers in voice analysis/synthesis used analog devices, such as lumped constant filters, electro-optical fre-

quency analyzers/generators, etc. Filters, particularly audio frequency wave filters of this type are large, heavy, and expensive. Fortunately, nearly all the old analog functions can now be equaled (or exceeded) with relatively inexpensive microcomputer chips or dedicated ICs.

Thus, digital processing is applicable to all three "popular" forms of speech synthesis today: formant synthesizers (FS), articulatory synthesis (AS), and waveform concatenation (WC).

Brute force digitizing of voice signals to reproduce telephone quality (e.g., 250 Hz-2800 Hz, and about 26 dB dynamic range) at the receiver is subject to the theoretical Nyquist minimum sampling rate criterion, among other things. But in this case, a practical sampling rate would be 2.5 x 2800 Hz, or 7 kHz. Then to accommodate a full dynamic range of 26 dB (at least 20 level quanta), a 5-bit binary word should be used to define the level of each 1.7000 second level sample of the speech signal. Thus, the minimum digitized voice signal becomes 7000 x 5, or 35 kHz. Since brute force digitization must more or less be used for music (it is so unpredictable), hi-fi digitized music takes awfully wide bandwidths.

Back in 1975, I went through the above types of arithmetical exercises when I sought to develop a real time voice encryption unit used on existing military radios and long distance telephone lines, both of which have the narrow passbands. The thought at the time was to first digitize the voice, then add a number from a pseudo random noise code generator. The receiving end used an identical pseudo random noise code generator. This was synchronized to the transmitter unit to decode the digital word when the random number was subtracted from each digital level word. This system works fine, but only with a passband of 25-35 kHz, a width NBFM military radios don't have.

Redundant Features

Obviously, brute force digitizing was not practical for existing narrow band voice circuits. All early workers agreed. Help came from Claude Shannon's work on information theory.

Harry Nyquist's minimum sampling rate barrier could not be assailed directly—it was written. The bright developers then turned to the basic human speech pattern to look for redundancy, and here they hit pay dirt. Unlike music, voice patterns are quite redundant. The duration of phonemes, basic sounds in speech, is 20-30 milliseconds, so using this knowledge, they believed that they had about 1.30-1.50 of a second in which to encode the phonemes and send a digital word defining each one, rather than a level sample every 1.7000 second. This approach could affect a sample rate reduction of at least 140 (that is, 7000.50). This implied that, regardless of which of the three synthetic approaches one takes, there are about 1.30-1.50 of a second to encode the basic building blocks of speech. And that is a long time for today's digital ICs.

Phonemes

Let's first consider the problem of identifying each phoneme in real time, that is, within about 1.30 of a second. For realism, one must consider the base frequency, amplitude, spaces, and rhythm of the phoneme. It becomes more difficult when considering differences in speech such as accent.

Here is a paraphrase from one of the best state-of-the-art survey papers on speech analysis/synthesis where the waveform concatenation (WC) synthesis is discussed.[1] Klatt

"Digitizing voice could be termed a sort of "audio teletype" where the transmitter operator's voice is automatically encoded into a lowest possible bit rate for transmission"

says it's possible to consider speech synthesis by concatenation; that is, by stringing together chunks of prerecorded or subroutine generated voice sounds, upon command from a real time speech analyzer. The syllable unit is not practical, because there are over 10,000 different syllables in English. The phoneme appears much more attractive because linguists say about 40 are found in English.

However, as of September 1987, all efforts to concatenate only 40 phoneme-size samples had failed because of "well-known coarticulatory effects," an effect between adjacent phonemes that cause substantial changes to the acoustic manifestations of a phoneme, depending on the context. Fortunately, these effects tend to be minimal at the center of the phoneme. One worker proposed to generate a synthetic phoneme which he called the "diphone." This comes from a sample made from the center of one phoneme to the center of the next. As 40 squared is 1600, there can be 1600 diphones, but it has been demonstrated that a usable system can work with only 1000.

In addition to the 40 English phonemes, there are about 14 commands for phoneme stress, silence, and syntactic considerations, such as primary stress and question intonation. Diphone duration was not mentioned, and that is important, too. So if one puts the 1000 diphone dictionary into binary code, it will take a 10-bit word. So, accepting a minimum diphone duration of 20 milliseconds, about 50 10-bit diphone words per second for a total bit rate of about 50 bits per second are required. Using the previous S/N link criterion, it would appear that a diphone approach could be realized with a 50 Hz passband, so let's say 100 Hz and be safe for now. In this system, the 1000 diphones for the synthesizer would easily be stored in a small ROM.

Now let us look at another approach to the problem, one that is in much use today.

Waveform Encoding

This second example of analysis/synthesis has been in existence for several years. Examples of instruments using this technique are talking clocks, and the Texas Instruments' "Speak 'n Spell" educational toy.

Waveform encoding works on the wave's time domain, rather than the frequency domain, as do the formant analyzer/synthesizers. It, too, relies on redundance of the phonemic waveforms. The technique, which uses linear prediction encoding of speech waveforms, estimates following waveforms from a weighted sum of about 10 previous waveform samples.[2]

Linear prediction analysis of speech does quite well for storing and playback of complete words or sentences, but for concatenating smaller pieces of speech to form new words or sentences, some difficulties arise. Words per se have been stored in waveform encoding at a rate of 1000 bits/sec in ROM. Compared to brute force binary encoding of voice at 32,000 bits/second, this is an impressive reduction, but using my S/N criterion, the improvement factor amounts to a FOM of 32%. Even so, this technique may be the easiest approach to a first generation system, since TI has the chips.

Demo Record Available

I strongly recommend the reader to copy the 52-page review and tutorial on text-to-speech conversion for English in the Acoustical Society journal. This Dennis Klatt production also included a vinyl demonstration floppy record, 33-⅓ rpm, tucked inside the cover of the Journal. The record demonstrated every practical form of speech synthesis used in the recent past and today. The reader can contact Klatt at Room 36-523 at MIT.

Charles WA3YQY has been a ham since 1939, and was first licensed as W2MKO. Though not an expert in voice compression, he has learned quite a bit about the subject during his tenure as a senior scientist for Lockheed Electronics until 1974, and most recently working for International Signal and Control. Charles now runs his own company called Rondout Electronics. His favorite aspect of ham radio is 75-meter and 10-meter phone operation. He also likes photography, yachting, and studying underwater acoustics.

References

[1]Klatt, Dennis H. "Review of text-to-speech for English" pp. 737-793, *Journal of the Acoustical Society of America*, Vol. 32, No. 3, 3 Sept 1987.

[2]Wiggins, R. "An Integrated Circuit for Speech Synthesis," *IEEE Int. Conf. Acoust. Speech Sig. Process. ICASSP-80*, pp. 398-401.

Voltage Sampling with a Computer

A Practical Project with an A/D Converter

by Joe Magee

Have you ever wondered how long it takes a battery to run down or just what the voltage drop looks like during those last few minutes? How fast does it get light in the morning or dark in the evening? Getting the answers to those and other questions has recently gotten much easier, thanks to Radio Shack.

One of the items introduced in the 1987 Radio Shack catalog is called an "8-Bit A/D Converter IC". The description further states "Complete Data Acquisition System in One IC". That is a big claim—I just had to buy one and find out.

The catalog description was pretty accurate. The only extra components you need are a power supply and a stable reference source. The finished product is an analog-to-digital (A/D) converter with a recommended range between 0 and 5 volts DC with an 8-bit resolution giving 256 steps of value between 0 and 5 volts.

Figure 1 gives the schematic. Everything in the schematic and all the hardware was purchased at Radio Shack and all the Radio Shack part numbers are given.

How It Works

The IC itself is a Texas Instruments TLC548. It contains a complete analog to digital conversion circuit. In addition to the power supply requirements mentioned above, only three data lines are required to interface it to a microcomputer. These lines are chip select, clock, and data.

Basically, to get data from the chip, the chip select line is pulled low, and the most significant bit (MSB) of the previous voltage conversion is presented on the data line. If the

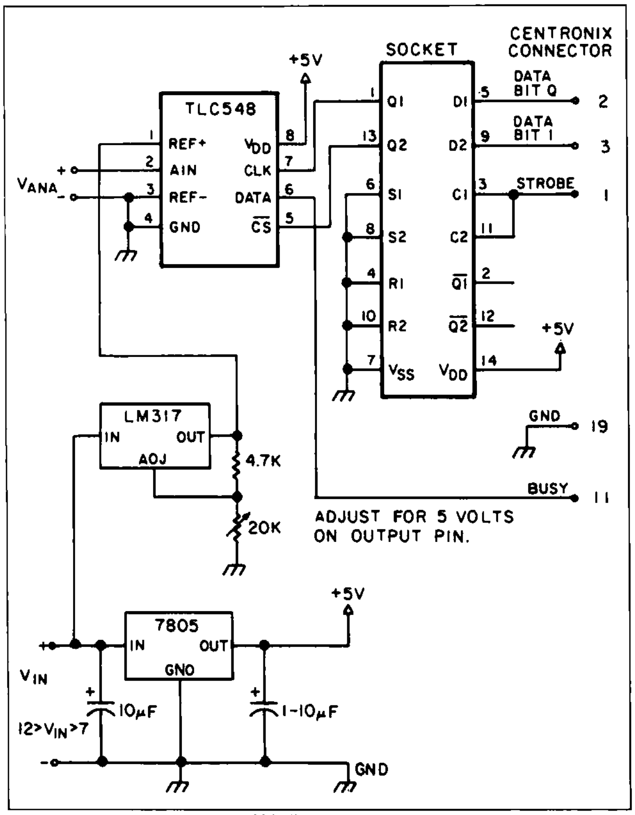


Figure 1. The simple electronics required to interface the TLC858 A/D converter to a Centronics parallel printer port.

```
1 ' ATOD.BA
2 ' JOE MAGEE, APRIL 16, 1987
90 CLEAR 256,62000        ' CLEAR ASSEMBLY LANGUAGE AREA
100 LET PA = 177 ' PIO PORT A, OUTPUT DATA
110 LET PB = 178 ' PIO PORT B, NOT USED
120 LET PC = 179 ' PIO PORT C, BUSY CONDITION RETURN
200 LET CH = 1   ' CLOCK HIGH PATTERN
210 LET CL = 254 ' CLOCK LOW  PATTERN
220 LET SH = 2   ' SELECT HIGH PATTERN
230 LET SL = 253 ' SELECT LOW  PATTERN
240 LET BB = 4   ' BIT POSITION OF DATA RETURN BIT
1000 GOSUB 10000 ' POKE ASSEMBLY LANGUAGE ROUTINE
1005 CLS
1006 RD = 1       ' COUNT OF READINGS MADE SO FAR
1007 PRINT "VOLTAGE ="
1008 PRINT "READING #"
1010 GOSUB 10400 ' LOWER THE SELECT LINE ON CONVERTER CHIP
1090 AN = 0       ' INITIALIZE ANSWER
1100 FOR I = 1 TO 8  ' LOOP READING 8 DATA BITS
1110 AN = (AN * 2) OR ((INP(PC) AND BB) / 4) ' SHIFT IN NEXT ANSWER BIT
1120 GOSUB 10600 ' RAISE CLOCK
1130 GOSUB 10800 ' LOWER CLOCK TO GET NEXT BIT
1190 NEXT I        GET ALL 8 BITS FROM CONVERTER
1200 GOSUB 10200 ' NOW RAISE SELECT BIT TO DESELECT CONVERTER CHIP
1290 PRINT @10,"";    ' CLEAR ANY PREVIOUS CONVERSION
1300 PRINT USING "#.##";(AN / 255) * 5.0 ' CONVERT ANSWER TO VOLTS AND PRINT
1310 PRINT @50,"";
1320 PRINT RD      ' PRINT COUNT OF READINGS MADE SO FAR
1330 RD = RD + 1  ' INCREMENT READN^ COUNT
1400 A$ = INKEY$ ' CHECK TO SEE IF OPERATOR WANTS TO STOP
1410 IF A$ <> "" THEN 9000 ' QUIT IF ANY KEY PRESSED
2000 GOTO 1010    ' OTHERWISE, GET ANOTHER READING
9000 ' WRAP UP ROUTINE
9100 CLEAR 256 MAXRAM ' RESTORE RAM TO SYSTEM
9990 END          ' DONE
10000 ' GET ASSEMBLY LANGUAGE PROGRAM INTO MEMORY
10010 READ X      ' GET COUNT OF BYTES TO DO
10020 FOR I = 1 TO X ' LOOP POKING INSTRUCTIONS
10030 READ D      ' READ NEXT ASSEMBLY LANGUAGE INSTRUCTION
10040 POKE 62001 + I,D    ' PUT IT INTO NEXT MEMORY LOCATION
10090 NEXT I      ' END OF POKE LOOP
10100 DA = SH     ' SET UP SELECT HIGH PATTERN
10110 GOSUB 11000     ' INITIALLY DESELECT CONVERTER CHIP
10190 RETURN      ' DONE WITH INITIALIZING ASSEMBLY LANGUAGE PROGRAM
10200 ' SELECT HI
10210 DA = DA OR SH   ' INSERT SELECT BIT HIGH PATTERN
10220 GOSUB 11000     ' WRITE NEW PATTERN TO PARALLEL PORT
10390 RETURN
10400 ' SELECT LOW
10410 DA = DA AND SL ' MASK OUT SELECT BIT
10420 GOSUB 11000     ' WRITE NEW PATTERN TO PARALLEL PORT
10590 RETURN
10600 ' CLOCK HI
10610 DA = DA OR CH  ' INSERT CLOCK BIT HIGH PATTERN
10620 GOSUB 11000      WRITE NEW PATTERN TO PARALLEL PORT
10790 RETURN
10800 ' CLOCK LOW
10810 DA = DA AND CL ' MASK CLOCK BIT
10820 GOSUB 11000     ' WRITE NEW PATTERN TO PARALLEL PORT
10990 RETURN
11000 ' WRITE PORT A
11010 POKE 62000,DA   ' PUT DATA FOR PARALLEL PORT WHERE IT CAN BE FOUND
11020 CALL 62002      ' CALL ASSEMBLY LANGUAGE PROGRAM TO WRITE DATA AT 62000
11190 RETURN
59999 ' ASSEMBLY LANGUAGE PROGRAM
60000 DATA 16
60010 DATA 243
60020 DATA 58,48,242
60030 DATA 211,177
60040 DATA 62,2
60050 DATA 211,224
60060 DATA 62,0
60070 DATA 211,224
60080 DATA 251
60090 DATA 201
```

Figure 2. BASIC program for TRS-80 Model 100 to read data from the converter.

```
(**********************************************************************)
(*                                                                    *)
(* Module Name:         atod                                          *)
(*                                                                    *)
(* Disk File Name:      atod.pas                                      *)
(*                                                                    *)
(* Purpose:             This program reads the serial analog to digital *)
(*                      converter and displays the result on the screen.*)
(*                                                                    *)
(* Revision History                                                   *)
(* Date     Programmer  Reason                                        *)
(*                                                                    *)
(* Author:              Joe Magee                                     *)
(*                                                                    *)
(* Date Written:        10/02/86                                      *)
(*                                                                    *)
(* Copyright (C) 1986. OM Systems                                     *)
(*                                                                    *)
(* Inputs:              none                                          *)
(*                                                                    *)
(* Outputs:             none                                          *)
(*                                                                    *)
(* Other Info:          none                                          *)
(*                                                                    *)
(**********************************************************************)

program atod:

var
  loop_count:   integer:
  reading:      integer:

{$i atodutil.pas}

begin
  clrscr;
  gotoxy(16,1);
  write('Serial Analog to Digital Converter Data Display');
  gotoxy(1,3);
  writeln('Voltage = ');
  writeln('Reading # ');

  atodinit;
  loop_count := 0:
  repeat
    reading := read_atod:
    gotoxy(11,3);
    write(reading / 255 * 5.0:4:2);
    gotoxy(11,4);
    write(loop_count);
    loop_count := succ(loop_count):
    delay(200);
  until keypressed;
end.
```

Figure 3. Turbo PASCAL program for an IBM PC clone to read A/D data.

```
(**********************************************************************)
(*                                                                    *)
(* Module Name:         various                                       *)
(*                                                                    *)
(* Disk File Name:      atodutil.pas                                  *)
(*                                                                    *)
(* Purpose:             This file contains utilities used to read the *)
(*                      serial a to d converter.                      *)
(*                                                                    *)
(* Revision History                                                   *)
(* Date     Programmer  Reason                                        *)
(* 10/05/86 Joe Magee   Modified for IBM PC                           *)
(*                                                                    *)
(* Author:              Joe Magee                                     *)
(*                                                                    *)
(* Data Written:        10/02/86                                      *)
(*                                                                    *)
(* Copyright (C) 1986, OM Systems                                     *)
(*                                                                    *)
(* Inputs:              none                                          *)
(*                                                                    *)
(* Outputs:             none                                          *)
(*                                                                    *)
(* Other Info:          See specifications for TI TLC548 a to d       *)
(*                      converter, sold as Radio Shack 276-1796.      *)
(*                                                                    *)
(**********************************************************************)

const

  busy_bit     = $80;       (* data bit 7 is busy bit                 *)
  clk_bit_hi   = $01;       (* clock is bit 0                         *)
  clk_bit_lo   = $fe;       (* lowers bit 0                           *)
  sel_bit_hi   = $02;       (* select line is bit 1                   *)
  sel_bit_lo   = $fd;       (* lowers bit 1                           *)

var
  port_data:   byte;        (* image of port 18 data                  *)
  cent_port:   integer;     (* port address of lpt1: data             *)
  busy_port:   integer;     (* port address of lpt1: busy             *)

procedure atodinit;
begin
  cent_port := mem[$0040:$0008] + 256 * mem[$0040:$0009];   (* from DOS *)
  busy_port := succ(cent_port); (* status at next address              *)
  port_data := sel_bit_hi;
  port[cent_port] := port_data;
end:

procedure select_lo;
begin
  port_data := port_data and sel_bit_lo;
  port[cent_port] := port_data;
end;

procedure select_hi:
begin
  port_data := port_data or sel_bit_hi:
  port[cent_port] := port_data;
end;

procedure clock_lo;
begin
  port_data := port_data and clk_bit_lo;
  port[cent_port] := port_data;
end;

procedure clock_hi;
begin
  port_data := port_data or clk_bit_hi;
  port[cent_port] := port_data;
end;

function read_atod:integer;
var
  i:         integer;
  atod:      integer;
begin
  atod := 0;
  select_lo;
  for i := 1 to 8 do
  begin
    atod := atod shl 1;
    if port[busy_port] and busy_bit = 0 then     (* busy inverted on IBM *)
      atod := succ(atod);
    clock_hi;
    clock_lo;
  end;
  select_hi;
  read_atod := atod:
end;
```

Figure 4. Utilities for the PASCAL program in figure 3.

clock line is raised and lowered, then the next most significant bit is presented to the data line. After 8 such clock transitions, all 8 bits of the conversion will have been available on the data line. The chip select is then taken high. Following this procedure one will get the previous conversion's data and initiate the next conversion.

"Only three data lines are required to interface (the A/D converter) to a microcomputer."

Connecting these signals to a microcomputer is most easily done through the parallel printer port rather than the serial port, even though this chip provides a serial data stream. Many serial data interfaces from microcomputers do not have clock signals available to send to external devices. Also, they are expecting RS232 voltage levels. On the other hand, a parallel port works with TTL (0 to 5 volt) voltage levels, and these are compatible with the TLC548.

Circuit Specifics

The schematic diagram indicates one IC and two voltage regulators. The IC is the TLC548. One of the voltage regulators is a 7805, or 5-volt regulator. An input voltage of at least 7 volts should be applied to the 7805 to generate a stable 5 volts for the Vcc pin of the TLC548. The other voltage regulator provides a reference voltage for the converter. The converter provides a count, or reading, that is proportional to the ratio of the unknown input analog voltage and the reference voltage. The TLC548 is designed to perform best with a reference voltage of 5 volts.

The voltage reference should be as accurate and stable as possible, and semiconductor devices exist for this purpose; however, Radio Shack does not stock any. Thus, the second voltage regulator is provided. Another 7805 was not used since these regulators are not specified to be exactly on 5 volts. Instead, an LM317 was selected. It is an adjustable regulator. After connecting power the first time, it was calibrated using an external voltmeter to provide as close to 5 volts as possible to the TLC548 for its reference voltage input. This is not as accurate or stable as would be desirable, but it is about all Radio Shack has to offer.

The specifications for the TLC548 imply that the maximum allowable input voltage on the analog (or unknown) voltage pin is Vcc + 0.3 volts and the minimum allowable voltage is -0.3 volts. With this restriction in mind, the -Vref pin and the chip ground pin are tied together. This means that the converter does not appear to have a true differential input and will measure only ground-referenced signals.

Other Hardware Considerations

In order to make this unit easy to interface to a large number of computers, I chose to use a 5-pin DIN connector on its I/O interface. Thus, with only one interface cable, the unit should interface to nearly any computer with a standard Centronics interface. If the computer has some sort of other connector on its parallel interface, a different cable will be required.

The circuit is constructed on a standard perfboard, catalog number 276-158. It is housed in a box, 270-627, which required several holes drilled and filed into it. Power is supplied by a 9 VDC wall transformer, 273-1455.

Some computers use the parallel printer port for more than one thing. This will cause extraneous signals to appear on the lines, which will confuse the TLC548. In order to avoid this, some type of latch was required. The extra IC, an MC14013, is a dual flip-flop capable of latching two data lines. Just enough for the chip select and clock. These data lines are latched into the MC14013 by using the strobe signal, also part of a

standard Centronics interface. On the converters I constructed, a socket for the MC14013 was included on the perf board along with a dummy socket not connected to anything. A header shorts pins 1 and 5 together and pins 9 and 13 together. Thus, if the computer in question had no extraneous signals on the parallel port, then the header would be put in the MC14013 socket. If required, the MC14013 itself would go into the socket. The unused device should then be stored in the dummy socket.

Software Requirements

Using the parallel printer port on a microcomputer solves some problems, but it raises others. The good points are that individual lines are easily controlled. This makes it easy to raise and lower the chip select and clock lines from software. However, very few parallel ports are bi-directional. By that, I mean that they are almost always output lines. There is no way to tell what the TLC548 is trying to send back.

However, all parallel printer ports have a busy line. Thus, to find out what value the converter is sending back, one needs only to monitor the busy line. The problem with this is that no popular microcomputer operating system allows for easy checking of the busy line of the parallel port. Moreover, trying to output anything to the port, such as new clock information, will not happen if the busy line is high. The operating system assumes a high level to mean that the printer is not available for new data.

In short, to use this converter, you must know something about hardware of the parallel printer port and write a program that can manipulate it properly. I will discuss three computers and give information required to communicate with the converter through their parallel printer ports.

The TRS80 Model 100

I chose this computer for the project because it is from Radio Shack and battery powered. This means that a remote data gathering setup is possible if the converter circuit is also powered from a battery. This is easy to do with any voltage greater than about 7 volts. Also, the Model 100 parallel port serves multiple purposes requiring the use of the MC14013 latch on the data lines.

Figure 2 is a listing of the BASIC program used to continuously read a voltage from the converter. The data statements are for a small assembly language routine used to send data to the parallel port. This routine is needed to disable hardware interrupts while this program sends data to the converter. It is a lot faster than using BASIC to send the same data out the port.

The BASIC program is short and to the point. The first few lines set up the needed constants. PA, PB, and PC are the addresses of the parallel ports in the 81C55 chip, a parallel I/O adapter. CH and CL are used to raise and lower the clock bit in the parallel printer port data byte. As each bit is taken from the converter chip, the next one must be clocked out by making the clock line high and then low. Data bit 0 is used as the clock bit. SH and SL are used to select and deselect the converter chip. In order for the chip to deliver the converted data and accept clock bits, it must be selected. This is done by lowering the select bit. In this application, the select bit could be left lowered, thus selecting the converter all the time, because no other hardware shares the data lines used to communicate with the TLC548. Finally, the variable BB defines the bit position held by the BUSY line in the status byte appearing on port c, PC, of the pio.

The program clears the screen and prints headings used to identify the value just read and how many times a value has been read. To read data from the converter, the program lowers the select line, uses a loop to clock in the 8 data bits, and then raises the data line.

Examining the loop reveals that the level of the data bit from the TLC548 is read in. As it is read in, it is shifted from bit 2 to bit 0 by dividing the input value by 4. The answer is then masked with a value of 1 to

```
(*********************************************************************)
(*                                                                   *)
(* Module Name:          atod                                        *)
(*                                                                   *)
(* Disk File Name:       atod.pas                                    *)
(*                                                                   *)
(* Purpose:              This program reads the serial analog to digital *)
(*                       converter and displays the result on the screen.*)
(*                                                                   *)
(* Revision History                                                  *)
(* Date      Programmer  Reason                                      *)
(*                                                                   *)
(* Author:               Joe Magee                                   *)
(*                                                                   *)
(* Date Written:         10/02/86                                    *)
(*                                                                   *)
(* Copyright (C) 1986, OM Systems                                    *)
(*                                                                   *)
(* Inputs:               none                                        *)
(*                                                                   *)
(* Outputs:              none                                        *)
(*                                                                   *)
(* Other Info:           This program released into the public domain *)
(*                       for non-commercial purposes. Joe Magee 04/16/87 *)
(*                                                                   *)
(*********************************************************************)

program atod;

var
  loop_count:   REAL;
  reading:      integer;

{$I atodutil.pas}

begin
  clrscr;
  gotoxy(16,1);
  write('Serial Analog to Digital Converter Data Display');
  gotoxy(1,3);
  writeln('Voltage = ');
  writeln('Reading # ');

  loop_count := 0;
  repeat
    reading := read_atod;
    gotoxy(13,3);
    write(reading / 255 * 5.0:4:2);
    gotoxy(13,4);
    write(loop_count:6:0);
    loop_count := loop_count + 1;
    delay(200);
  until keypressed;
end.
```

Figure 5. Turbo PASCAL routine for the Kaypro 4-84 computer to read and display the digitized data.

```
(*********************************************************************)
(*                                                                   *)
(* Module Name:          various                                     *)
(*                                                                   *)
(* Disk File Name:       atodutil.pas                                *)
(*                                                                   *)
(* Purpose:              This file contains utilities used to read the *)
(*                       serial a to d converter.                    *)
(*                                                                   *)
(* Revision History                                                  *)
(* Date      Programmer  Reason                                      *)
(*                                                                   *)
(* Author                Joe Magee                                   *)
(*                                                                   *)
(* Date Written:         10/02/86                                    *)
(*                                                                   *)
(* Copyright (C) 1986, OM Systems                                    *)
(*                                                                   *)
(* Inputs:               none                                        *)
(*                                                                   *)
(* Outputs:              none                                        *)
(*                                                                   *)
(* Other Info:           See specifications for TI TLC548 a to d     *)
(*                       converter, sold as Radio Shack 276-1796.    *)
(*                                                                   *)
(*                       This program released into the public domain *)
(*                       for non-commercial purposes. Joe Magee 04/16/87 *)
(*                                                                   *)
(*********************************************************************)

const

  cent_port     = $18;        (* centronics data port             *)
  busy_port     = $14;        (* centronics busy signal port      *)
  busy_bit      = $40;        (* d6 is busy bit                   *)
  clk_bit_hi    = $01;        (* clock is bit 0                   *)
  clk_bit_lo    = $fe;
  sel_bit_hi    = $02;        (* select line is bit 1             *)
  sel_bit_lo    = $fd;

var
  port_data:    byte;         (* image of port 1s data            *)

procedure atodinit;
begin
  port_data := sel_bit_hi;
  port[cent_port] := port_data;
end;

procedure select_lo;
begin
  port_data := port_data and sel_bit_lo;
  port[cent_port] := port_data;
end;

procedure select_hi;

begin
  port_data := port_data or sel_bit_hi;
  port[cent_port] := port_data;
end;

procedure clock_lo;
begin
  port_data := port_data and clk_bit_lo;
  port[cent_port] := port_data;
end;

procedure clock_hi;
begin
  port_data := port_data or clk_bit_hi;
  port[cent_port] := port_data;
end;

function read_atod:integer;
var
  i:          integer;
  atod:       integer;
begin
  atod := 0;
  select_lo;
  for i := 1 to 8 do
  begin
    atod := atod shl 1;
    if port[busy_port] and busy_bit <> 0 then
      atod := succ(atod);
    clock_hi;
    clock_lo;
  end;
  select_hi;
  read_atod := atod;
end;
```

Figure 6. Utility routines for the program in figure 5.

isolate the bit. Then this value is added to the variable AN, thus building the final answer.

The converter chip yields a number from 0 to 255. This number is the ratio between the analog input voltage and the analog reference voltage on the chip. The actual voltage read can be calculated by multiplying the reference voltage by the ratio of the returned count and maximum count.

For instance, if the input voltage is exactly 1 volt, the ratio of 1 to 5 is .2. The value read will be .2 times the maximum count (255) or 51. Dividing this value by the maximum count will give this ratio, and then multiplying the ratio by the reference voltage gives the answer: (51/255) x 5.0 = 1.0.

The rest of the program is devoted to displaying the answer and checking the keyboard. If the operator presses any key, the program terminates.

The small assembly language routine actually writes the clock and select line levels to the converter ship. Because the data lines used in the parallel port are shared by the keyboard scan hardware, this scan must be stopped while the converter is communicated with. In addition, while not addressing the TLC548, the data lines on the port change value while the keyboard is scanned. This dynamic changing data pattern confuses the converter and cause invalid results to be obtained. To avoid this problem, a latch is installed in the converter circuit as discussed above. The strobe line, a part of all parallel printer interfaces, is used to latch the desired levels of the clock and select lines to the TLC548. The strobe line toggling is also handled by the assembly language routine.

A/D Converter Parts List

TLC548 8-bit D/A converter	RS #276-1796
7805 5-volt regulator	RS #276-1770
LM317T adjustable regulator	RS #276-1778
10 uf capacitor	RS #272-1013
4.7 kΩ ¼ resistor	RS #271-0340
20 kΩ variable resistor	RS #271-1330
Optional parts:	
5-pin DIN jack	RS #274-0005
8-pin W/W socket	RS #276-1988
16-pin W/W socket	RS #276-1994
DC power connector	RS #274-1575
Experimenter's box	RS #270-0627
Perf board	RS #276-0162
Wall power supply	RS #273-1455

Ubiquitous PC Clone

One good thing about IBM computer clones is the care taken to match the IBM hardware. This means that nearly any PC-DOS or MS-DOS computer with a parallel printer port will probably have exactly the same hardware at an I/O address that is easily obtained. Figure 3 is a Turbo Pascal program that will obtain the address of the LPT1: port and use it to read the converter.

The main portion of the program is very short. We will cover it first. As in the BASIC program, the screen is cleared and descriptive titles are printed. In addition, a loop or reading counter is initialized.

The rest of the program (figure 4) is in a file called "atodutils.pas". This file contains procedures and functions to initialize the IBM hardware and to take a reading from the analog to digital converter.

Reviewing this file, the definitions of the various bits and their positions comes first. In the IBM program, the address of the parallel printer port must be determined. The operating system conveniently keeps this address at location $0040:$0008. This is a strange looking address. The first number, $0040, is the paragraph number to use as the base of the actual physical memory address. A paragraph is 16 bytes long. In the Intel 8088 world, memory addresses are defined as a base address and an offset. Each base, or paragraph, address can point to up to $10000, 65536, individual physical addresses. These numbers are called the offset, and they form the second part of the address description; that is, the ":$0008" above.

In any case, as mentioned, the contents of that address is the base port address of the parallel printer port assigned as LPT1. The data for the port is at the base address, and the status is at the next higher address.

In addition to getting the address, the initialization program also sets the select bit high on the TLC548. It also initializes a variable, "port-data," to equal the value just written. This is necessary, because the value just written cannot be read back in from the data port. The only way to know the value is to save it somewhere. Notice that in this case, no strobe line toggle is necessary. The IBM, the parallel printer port is dedicated to the printer alone and no other data will appear on it. Thus, the latch in the converter circuit is removed. In my prototype, I simply unplugged the MC14013 device and replaced it with the jumper block already described and stored the MC14013 in the spare socket.

The function that reads the measured value is simpler than it looks. It starts out with a read value of 0 and adds in the values from the TLC548 one at a time.

The first step is to lower the select line as in the BASIC program. Notice that this is done by a logical AND between the current value in the parallel port with a constant called "sel_bit_lo." "Sel_bit_lo" has a value of $fe. When this value is ANDed with the port value, bit 1 of the port value will unconditionally set to 0, and all others will remain as they were. In the value $fe, bit 1 is a zero, and all others are ones.

Most of the rest of the function is a loop that gets the current data bit from the converter chip and saves it. First the accumulated answer is shifted to the left to make room for the next data bit. The data bit value comes in on the busy bit of the printer port. In the IBM this bit is inverted. Once again, the logical AND trick is used to determine the value. In this case the constant is $80, because the busy signal is in bit 7 of the status data. This time, we want to know the value of that bit, so all the other bits are 0. Thus, with a logical AND all bits will set to 0 except bit 7. Bit 7 will be remain unaffected. If it is 0, then the bit coming from the TLC548 was a 1 and the least significant bit of the answer is set to a 1 by simply adding 1 to the value. Then the clock line on the converter chip is toggled to bring out the next data bit. After the loop, the select line is returned to a high value, and the converted value is returned to the procedure that called the read-atod function.

The main routine calls the read function. It then takes the converted value and makes it into a voltage, just as in the BASIC program above. This value is displayed on the screen. A small delay is included in the program to make the answer readable. If the voltage read is not exactly on a value that is one of the 256 steps between 0 and 5 volts, the answer may fluctuate between the closest such values. This program can read and display the voltage so quickly that the screen display can flicker between the different values and the actual number cannot be read before it changes. The small delay gives us poor humans a chance to catch up with the machine. The last statement is a check of the keyboard. If any key is pressed, the program stops.

The Pickup Truck of the CP/M World

The CP/M world is not as lucky as the MS-DOS world. Standardization of port addresses and hardware did not occur. I have several CP/M computers, but the one that I use the most is a Kaypro 4-84. It is representative of a CP/M computer, and the parallel port on it is similar to other Kaypro 8-bit computers. The program (figures 5 and 6) is very similar to the one for MS-DOS, since it also is written in Turbo Pascal. However, the programmer must determine the address of the parallel printer data and status ports. This information is available in the documentation which comes with the Kaypro. As in the IBM, the printer port is dedicated to the printer and no strobe line toggling is required. If you have a different CP/M-80 computer, this program can be used if you determine the hardware addresses of your printer data and status ports. You will also need to know the location of the busy line bit in the status port, and whether any other data appears on that port. Most likely, however, in a CP/M computer the data port will be dedicated to the printer.

There you have it. Get busy! If you have a computer, you should be able to go down to Radio Shack and get the parts needed to let you too turn it into a voltmeter. Next week you should be able to tell me things like how long it takes a battery to discharge, or what time the sun came up 7 days in a row, or maybe the average S-meter reading on 20 meters over a 24 hour period. Let's see, how about the temperature for the last 24 hours? I'll have to think about that one. 73

Number 20 on your Feedback card

PACKET TALK

Latest in Digital Hamming

Brian Lloyd WB6RQN
19200 Tilford Way
Germantown MD 20874

Building a Duplex Digipeater

I promised some time ago to present details of the duplex digipeater that our group uses in the Washington DC area. It's a simple device that requires little hardware and no software.

The first step in constructing a duplex digipeater is to choose a frequency and a site. The group chose the frequency pair on 220 MHz to conform with standard voice repeater operations, i.e. frequency and split. The group's initial duplex digipeater had the frequency assigned and coordinated by The Mid-Atlantic Repeater Council (TMARC) as if it were a voice repeater.

Since that time, there have been changes in Part 97 of the FCC regulations that differentiate between digital communication devices and ordinary repeaters. It's now permissible to construct a duplex digipeater and operate it in any portion of the amateur radio spectrum above 50 MHz where the emission mode is legal, provided the transmissions use the AX.25 protocol. This means a duplex digipeater can operate on two meters outside the standard repeater subbands of 144.5–145.5 and 146–148. Our group has two new duplex digipeaters under construction that have inputs in the range of 145.6–145.7 and outputs in the range of 145.0–145.1, using the standard 600-kHz split.

Hardware Selection

There are four major pieces of the duplex digipeater: the duplexer, the receiver, the modem, and the transmitter. The duplexer is any standard duplexer used for normal repeater operation. Our group has been quite satisfied with the performance of a WACOM four-cavity duplexer.

The receiver is any NBFM receiver. The group uses a Midland 13-509, but just about any receiver should do. A receiver designed for repeater service is a better choice due to the higher quality and wider environmental tolerance designed into these devices.

The group's modem is a Bell 202T look-alike produced by Rixon found at a hamfest for about $40. This turned out to be a very good performer, because its carrier detect circuitry doesn't trigger on voice signals. Only a valid Bell 202 carrier causes the carrier detect to assert. This is very important, because the carrier detect signal of the modem is used to key the transmitter.

The transmitter is the transmitter section from a Midland 13-509 but just about any NBFM transmitter will do. As in the case of the receiver, a transmitter designed for repeater service is probably the best choice. Be sure to have full schematics for the transmitter for slight modifications to ready it for duplex digipeater operation.

Signal Flow

It's imperative to have the duplex digipeater key and unkey very rapidly in response to packets at the input. The duplex digipeater output alerts all other users to activity on the channel and to stand by until the channel goes clear. This is what carrier sense multiple access (CSMA) is all about. In order for this to work, the duplex digipeater needs to key up the transmitter as soon as a valid data carrier is detected by the modem. The following diagrams and directions should help.

The incoming signal goes directly from the detector in the receiver. The receiver's squelch and COR (if it is a repeater receiver) are NOT used. The signal from the detector travels to the buffer amplifier shown in Figure 1. Buffer adjustment consists of applying a 5 kHz deviation, 2200 Hz modulated signal to the receiver, and adjusting R2 to provide a 0.77 Vrms (0 dBm) signal at the buffer output.

The buffer output goes to the input of the Bell 202T modem. The data output of the modem is looped back to the data input of the modem, regenerating the tones. The modem output goes to the transmitter input AFTER all signal processing stages. The modem signal MUST enter the transmitter as close to the modulator as possible. Be sure to bypass all microphone preamp, limiter, and low-pass filtering circuits in the transmitter. Usually the wiper of the deviation control is a good place to inject the signal (See Figure 2). Adjust the modem output level so the 2200 Hz high tone produces exactly 3 kHz deviation.

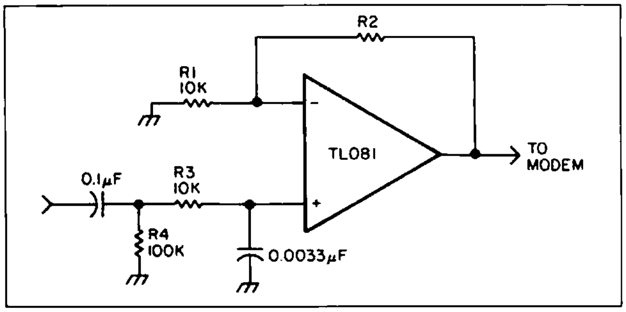


Figure 1.

The transmitter requires one special modification in order for it to key very rapidly and still provide good signal stability. Wire the transmitter so all stages are powered all the time. In order to key and unkey the transmitter rapidly, one of the intermediate stages in the transmitter needs to be keyed. Since the amplification and multiplication stages of most FM transmitters operate Class-C, the transmitter is stable and quiet with no drive. I modified the last multiplier stage so its emitter is keyed by a small keying transistor, which is turned on (keyed down) by the application of a positive voltage. Be sure to use plenty of bias on the emitter of the keyed stage to ensure its continued stability. See Figure 3.

In a Nutshell

A received signal is amplified and buffered by the buffer amplifier and presented to the demodulator in the modem. Only a valid data signal activates the data carrier detect (DCD) line. The DCD line turns on the keying transistor, which pulls the emitter of the last multiplier stage to ground turning the multiplier on. This allows RF to pass from the multiplier to the amplification stages in the transmitter (our transmitter keys in about five microseconds). The data is detected by the demodulator in the modem and passed to the modulator through the jumper between pins 2 and 3 of the RS-232 connector. The regenerated tones now modulate the transmitter.

So far this technique has worked very well. The keyup delay is only 8 msec—essentially the time it takes the modem to detect carrier. Since the modem does a very good job at differentiating between noise, voice, and valid data, it's almost impossible to get the duplex digipeater to falsely key up. The duplex digipeater remains keyed until the signal goes away. (One can always add a watchdog timer that will unkey the transmitter after some period of time, say a minute, should someone's TNC stay on the air too long.)

Since the duplex digipeater has no IDer of its own, one of the TNCs on the frequency should broadcast an ID packet for it at least every 10 minutes. This should keep everybody happy and everything legal.

> ***"A duplex digipeater can operate on two meters outside the standard repeater subbands."***

A Few Caveats

Don't try to use the COR in an existing repeater receiver to key the transmitter. The squelch in most receivers is too slow to work effectively and it cannot differentiate between a voice and a data signal. The duplex digipeater must pass only data to be eligible for operation outside the repeater subbands.

Don't try to key the transmitter by keying the audio and oscillator stages of the transmitter (this is how most repeater transmitters are keyed). The transmitter needs to key up more quickly than most of these stages can accommodate.

Use a Bell 202T modem that

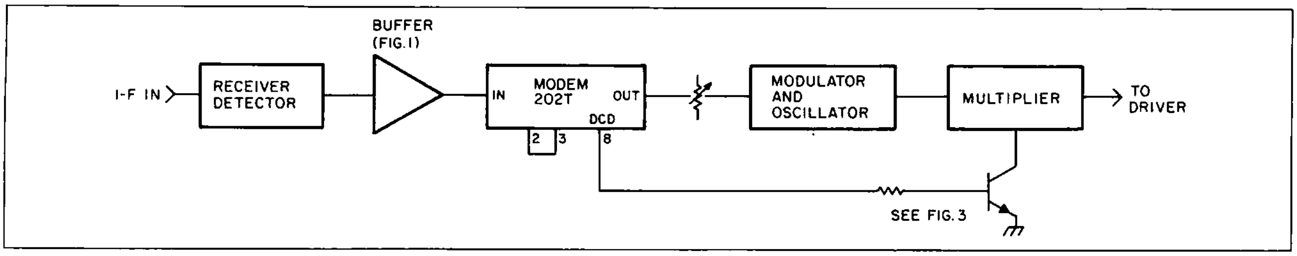


Figure 2.

does not falsely trigger on voice or noise. For this reason, neither the 2211 PLL nor the 7910 world modem chips used in most TNCs are suitable. The 2211 will not reject voice and the 7910 will assert DCD for any signal, even noise.

Go build one! Find out what packet radio is like when everyone in your area can "hear" everyone else. Just be sure to remind users to turn on the duplex switch on their radios prior to attempting connections to their neighbors directly (no digipeater specification required).

Backbones

One of the biggest problems facing amateur packet radio is how to build long-haul networks that pass data efficiently without losing it. Digipeaters were not very useful for constructing long-haul backbones. Packet loss rates rendered them useless for more than one or two hops. The proliferation of NET/ROM and bulletin boards was an attempt to solve this problem. Bulletin boards act as store-and-forward devices and NET/ROM added link-layer acknowledgments (hop-by-hop ACKs) in an attempt to make each link appear to be more reliable. This improved things somewhat but didn't solve the problem. It just made it less visible. The real solution is to make the links truly reliable.

The measure of link reliability is its packet loss rate. A reliable link doesn't lose packets. Packets are lost for two major reasons: poor link implementation and collisions. The reliability of a link can be improved by properly adjusting the modems, radios, and antennas to ensure that transmitted packets will be received with a very low probability of error. Collisions can be avoided by ensuring that only one transmitter uses the frequency.

The first suggestion, proper installation and adjustment of the hardware, seems straightforward but the second suggestion, that of having a single transmitter to a frequency, seems rather unusual. How can there be a network with only one transmitter to a frequency? The key to this issue is proper network topology. It requires some rethinking about packet radio based networks.

Collision-Free Network

Phil Karn KA9Q wrote a very interesting paper for the ARRL 6th Computer Networking Conference entitled "A High Performance, Collision-Free Packet Radio Network." The interesting thing about Phil's paper is that the concepts presented therein apply to any radio-based network regardless of networking protocol! These concepts will work for TEX-Net, NET/ROM, TCP/IP, ROSE (COSI), or even plain vanilla AX.25 with digipeaters. A network based on Phil's ideas, in addition to being collision-free, is also inherently full duplex! Here is a general description of how a network based on Phil's ideas would work.

Every node in the network has one and only one transmitter. That transmitter operates on a frequency assigned to only it for a region. Each of the adjacent network nodes has a dedicated receiver and possibly an antenna to listen to that frequency. This means that each node in the network has one transmitter on its own frequency and one or more receivers each tuned to the transmit frequency of the adjacent network nodes. The transmitters should probably use omnidirectional antennas and the receivers should use directional antennas to increase link signal margin and reduce interference from undesired signals.

To make the network easier and less expensive to implement the transmitters at adjacent nodes should probably operate on different amateur bands. This reduces or eliminates the need for cavities or duplexers at a site.

Do not discount 6m and 2m as link bands. Users can transmit signals up to 20-kHz wide on these two bands. The 220 and 430 MHz bands allow signals up to 100 kHz wide. For bands above 450 MHz, the signals can be as wide as the band itself. Based on these bandwidths, speeds of 9,600 bauds (6m and 2m), 56,000 bauds (220 MHz and 430 MHz), and 10 Megabauds (902 MHz and up) are possible.

The packet switch hardware at each node must handle multiple receivers and a single transmitter. Currently the KA9Q TCP/IP networking code supports this topology and, with only a slight modification, the multiport digipeater and NET/ROM code could also. Imagine a network where eight digipeater hops are considered normal and acceptable with negligible packet loss rates!

Users should have access to the network on a seperate band from backbone links. This is where the duplex digipeater comes in. Local users communicate with one another through the duplex digipeater. Should someone wish to communicate with another user reachable only through the network, the packets are switched off the LAN and onto the backbone. When the packet finally arrives at the destination LAN, it is switched to the duplex digipeater and then delivered to the destination.

Our group is constructing a network that uses duplex digipeaters to define and support the LANs and has a collision-free backbone to tie the duplex digipeaters together into a single network. The network node switches will support NET/ROM, TCP/IP, and AX.25 digipeater connections. Users will have their choice of networking protocols all with a very high probability of packet delivery. I will keep the readers posted on this progress.

NET/ROM Update

There are two significant developments of interest to the NET/ROM users. First, the Northern Germany Packet Group has written a NET/ROM replacement package and placed it into the public domain. This package is fully compatible with NET/ROM version 1.3, but has no encrypted callsigns. The software is in the public domain and is available in either source ('C' plus a tiny bit of assembler) and/or object code format. Those interested in information or a copy of the software should contact:

Michael Roehner DC4OX
Hans Georg Giese DF2AU
Hinter dem Berge 5
D3300 Braunschweig, FRG

There is also a new version of the KA9Q TCP/IP code that is NET/ROM compatible. This code permits a TCP/IP station to be part of a NET/ROM network, passing both AX.25 and TCP/IP traffic over the same link at the same time. This code doesn't support end-user NET/ROM access (i.e., it does not allow connections with an ordinary TNC), but it's ideal for a backbone packet switch with restricted backbone access. A vote of thanks and a hearty "well done" go out to Dan Frank W9NK for this addition to the KA9Q TCP/IP net package. 73

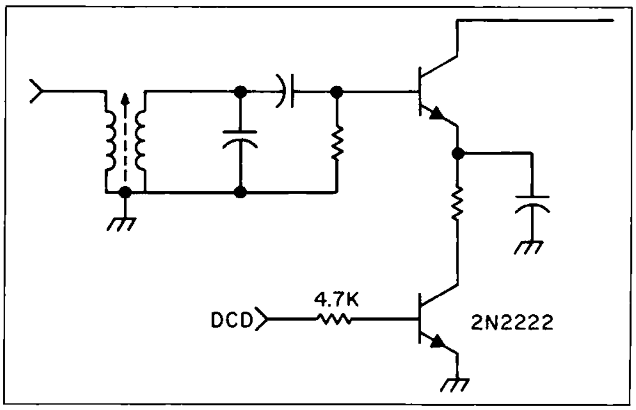


Figure 3.

Number 21 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc Leavey MD WA3AJR
Jenny Lane
Pikesville MD 21208

Teleprinter Machines

This month's RTTY Loop column takes a look at the models the Teletype Corporation produced. Although other companies, notably Kleinschmidt, have produced teleprinter machines, those from the Teletype Corporation have the widest circulation in the amateur RTTY community.

Baudot/Murray Machines

First on the list is the Model 12. This ancient boat anchor allowed many an amateur to use RTTY in the early days. With six magnets in the typing unit, each requiring 300 mA of current, it generated more electrical noise rather than mechanical noise, (the latter still being considerable). This is a machine for masochists.

The Model 14 series are strip printers and tape punches.The tape versions of this series are commonly combined with the Model 15 into a Model 19. More on those in a paragraph or so.

The Model 15 is the "standard" if ever there was one. This machine comes immediately to mind when someone mentions "Teletype." This sturdy page printer runs on a 60-mA loop supply, and will stand up to use day in and day out, longer than an amateur will want to run it.

The Model 19 is equivalent to a Model 15 on a table with a Model 14 tape punch. (Who knows why it's not called the Model 29?) It's the forerunner of today's "ASR" (Automatic Send-Receive) sets. The Model 19 is still in service at many installations.

The Model 26 is a machine designed for light duty. This machine is remarkable for moving the paper past the type head, like a typewriter, rather than the other way around as most modern printers do. This is a transitional machine. It has an early daisy-wheel printing device. There aren't many of the Model 26s around any more.

The Model 28 was the first machine to break into the modern RTTY era. With multiple gears to run 60, 75, or 100 wpm, it was the window into high-speed RTTY. There are many of these babies still in use.

The Model 31A is a strip printer! This 20-pounder was designed for "portable" use, within the definition of portable in the late 1960s. I have not seen or known anyone who has this specimen.

The Model 32 is a modern five-level teleprinter, which may as well be the ultimate machine. It's the Baudot version of the Model 33, a familiar machine to the ASCII crowd.

ASCII Machines

The Model 33 is the standard in ASCII teleprinters. This modern teleprinter has many versions. Use the "Call Control Unit," which is on the right plate of the machine, as a key to learn what the machine is wired for.

The Model 35 is the ASCII version of the Model 28. Even though this is an ASCII machine, many of the internal parts are the same as the Model 28, and interchangeable. Note that although the selector magnets in the Model 35 have a rather high current demand (500 mA), an internal selector magnet driver takes care of the interfacing. The Model 35 tends to be the heavier-duty version of the Model 33.

Thanks to the people who offered information on various machines, especially Bob Roehrig K9EUI, R. Lee Hagan K4OZQ, Doug Reed, and Tom KA4RKT (via CompuServe).

WWV

I mentioned WWV two months ago and wondered if decoding the encoded information was possible. Well, Bob K9EUI also passes along the information that the National Bureau of Standards publishes a guide to the WWV time-code format. WWV and WWVH use the same format, and WWVB uses a somewhat different format. The WWV format is a one pulse per second code on a 100-Hz subcarrier. It's a binary format and it gives the minute, hour, and day of the year. The length of the burst of the subcarrier determines the binary value of each bit. Those interested in this information should write for *NBS Special Publication Number 432*, NBS Time and Frequency Dissemination Services. Send your request to the Time and Frequency Division, National Bureau of Standards, Boulder, Colorado 80302.

PC RTTY

Bill Kantz WD2AEV sent in a query via CompuServe. Bill has a copy of a RTTY program for PClones called BAUDOTC.EXE. He said that the docs with the program claim to have source code available, but he can't find it anywhere. He's looking around for information on RTTY for the PC.

Well, there are quite a few public domain programs for the PClones. One I have looked at is available on CompuServe's HamNet for downloading. RTTY.EXE was written by Perry Taylor WØSE, and T.L. Vinson WØNW. It seems to be a rather full-featured program, with selectable speeds, modes, disk access, and the like. Free for the taking and that may be hard to beat. The reader might make note also of WØKU, a net user, who also asked about PClone RTTY via the Delphi information system.

KB8BMN sent along a Delphi Mail message, wondering about slow scan programs for the CoCo. Well, the first one that comes to mind is Marty Goodman's famous WEFAX program. It's a transmitting version and is available on Delphi for downloading. This may be just the ticket for the ham who wants to try SSTV on a shoestring. Hardware solutions are around as well, of course, with the AEA PK-232 described here a while back, leads the pack. The cost of the AEA PK-232 may be more money than one is willing to plunk down to try something out.

CoCo Instructions

Several hams have received a copy of January's RTTY program for the CoCo on tape and have asked for more specific information on how to use the program. The tape will have two programs on it. First of all, there are three CSAVEs of RTTY.BAS. This is the driver program for the RTTY routines, and will be the program to run first to get the thing started. So, CLOAD RTTY into the computer, then CSAVE RTTY onto a new tape only once. Now, put the tape back in and CLOAD MAKERTTY. The MAKERTTY program is a BASIC program that will create a binary program, usually called RTTY.BIN. This is the "gut" of the program.

Therefore, after loading MAKERTTY, put the new tape back into the recorder, position it right after the RTTY.BAS program. Push the RECORD buttons and type RUN. The computer must know the amateur is working from a cassette. It will save RTTY.BIN right after the BASIC loader.

Now, rewind the new tape and turn the computer off for a few seconds to reset. Put the new tape in, press PLAY, and type CLOAD RTTY. When the BASIC program is loaded, RUN it, and the computer will load the binary routine and start the ball rolling. Okay? Is that clear enough? Let me know.

Odds and Ends

Jim W. Pook is a Canadian friend who would like to monitor RTTY on his Apple II-gs. We have covered Apple software before, and I have sent Jim a list of what I know about that software. But, with the enhanced capabilities of the II-gs, I would think that there should be some new and exciting programs on the market.

Manuals and books are the object of Robert E. Becker's search for RTTY information. On the market, the current information is precious and very little, besides what I've talked about here in the column. I like to think that RTTY Loop remains one of the most current sources of RTTY and ham-computer information. While there isn't a "book" of RTTY Loop columns, back issues are available from little old me. Send me a self-addressed, stamped envelope and I will send an index of this column dating back more than ten years.

Input from readers has been heavy this month, by mail and computer. Let me hear from you! Send letters to the above address, with a self-addressed, stamped envelope for personal replies, or Email via CompuServe (ppn 75036,2501) or Delphi (usemame MARCWA3AJR). I always look forward to hearing from the amateurs.

Some of the most exciting hardware and software items have tickled my interest lately, and they will show up here in RTTY Loop. Not only that, but as I write, the Greater Baltimore Hamboree and Computerfest is on the horizon with goodies galore to fill next month's column. How can that be missed?

Check that subscription label on the wrapper of *73* right now, before it gets thrown out, and make sure it hasn't run out. The last thing you want to do is miss next month's RTTY Loop! ■

Number 22 on your Feedback card

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B
3353 Fieldstone Dr.
Doylestown PA 18901

TX MIXER BOARD FOR LMW 2304

Last month's column covered the Universal Local Oscillator (ULO), Receive Mixer, and IF Amplifier sections of the LMW 2304-MHz transverter kit. This column details the Transmit Mixer board construction, as well as the completed chassis and on-air performance.

Overview

Figure 1 shows the the transmit mixer board. This is the most intricate stage to assemble and perhaps the trickiest to align! The somewhat obscure pictorial diagram doesn't help matters. The schematic is correct and the final word on parts placement.

The design is quite simple. 144-MHz drive is injected through a large resistive pad that allows up to a 10-watt signal level. A 100Ω potentiometer adjusts the saturated drive. This output is connected to a diode mixer stage. A pair of HP2835 diodes function as a ring mixer stage, but there is not a lot of conversion gain. Due to this, the 144-MHz drive needed for saturated output is typically 1–2 watts. This level is easily obtainable.

The ULO board has more than adequate output at 1080 MHz (see last month), delivering between 40 and 50 mW across 50Ω. This signal is injected into TR1, an NEC 85637 bipolar device functioning as a doubler stage. Gain is about 3–4 dB and the output at 2160 MHz is fed to the ring mixer stage. Tuning here is critical, both to suppress the unwanted 2160-MHz LO signal and peak the desired 2304-MHz mixer product.

This stage is followed by five Class-A stages that run straight through at 2304 MHz and develop about 4–5 dB each. TR2 to TR5 are also NEC 85637 bipolar devices. TR6 is a Phillips BLU98 stage that develops 400–500 mW output maximum. All stages except TR6 run at 8 volts derived from a regulated bus line. TR6 is a more conventional 14-volt stage, and takes its power directly from the 13.8-voit input.

Construction

The assembly is quite tricky—check work often against the schematic. Of all the pictorial diagrams in the kit, this is by far the hardest to read. The importer, Bill Olsen of Down East Microwave, plans to have some of diagrams redrawn to alleviate this problem.

Perhaps the trickiest area of the board are around the driver and final stages. Here, the builder must carefully solder coils, resistors and diodes in a tiny area. For example, the pictorial does not show a 47Ω ¼W resistor from the base of TR5 to its associated choke, but the schematic does. Furthermore, placing the resistor with minimum lead length and attaching the choke (1 turn of wire with 4mm inside diameter) presents quite a challenge! I cut the leads down so far they were virtually non-existent and stood the resistor on end, making the shortest possible connection to the choke.

Also make sure to solder ALL the plated-through holes around the PC board, especially at the ground end of each etched inductor. I missed a few the first time, which adversely affected the unit's performance. LMW supplies strings of tiny pins to push through the holes and solder. They often don't fit without extra drilling, so use cut-off leads from components instead. Form these into a tight "U" shape and insert them into the board. After soldering, clip the leads flush to the board.

The trimmers are also tricky. The tiny leads at the head of the trimmer need to pass through the PC board to solder on the backplane. Pull them as tight as possible while holding the trimmer flush to the top of the PC board, and apply solder to make a smooth flux. Clip the excess leads as close to the board as possible. The trimmer bodies are made of a gold alloy and solder quite easily to the circuit traces. Use a low-wattage iron (40 watts is plenty) and tin them slightly before fluxing the solder to the trimmer body.

There are plenty of small chip capacitors—cautiously solder them to the designated points. These devices are susceptible to high heat, so just lightly flux solder over the ends. DON'T APPLY HEAT DIRECTLY FROM THE SOLDERING IRON!! There are only enough chips to make the kit work. Replacements have to be ordered from Down East.

Install the transistors last. LMW instructs the builder to pass the emitter leads for TR1–TR3 through the mounting holes and solder them to the backplane for the lowest impedance ground. Since the holes aren't large enough, enlarge them with a hand drill.

TR4, TR5 and TR6 solder entirely to the top of the board. (I mistakenly soldered the emitter leads from TR4 to the backplane, but it had no apparent adverse effect.)

Create the regulated 8-volt bus by strapping #22 wire between each of the insulated feedthrough capacitors. Again, enlarge the too-narrow holes with a hand drill. Install the feedthroughs with the solder flange on the backplane side and flux each flange completely to make a well-grounded and mechanically secure connection. I used uninsulated wire for the bus, but any type will suffice.

The DC voltage regulator mounts to the backplane. Apply a small coating of silicon grease (not included) since the regulator gets plenty warm during use! Bend the leads carefully to make sure the flange lines up with the screw hole punched in the board, and fasten securely. The DC relay fits nicely into its pre-drilled holes.

The remaining components are easy to install. Most of them go on the top of the PC board. Cut the leads as short as possible to keep a low profile when installing the diode bias networks. Watch the resistor markings! I mistakenly installed 100Ω types where 10Ω resistors were called for and vice-versa. This made things quite exciting on initial power-up.

Tune-up

First make sure the 8-volt bus functions correctly. Do this before connecting any of the collectors from TR1 through TR5.

Next, determine the operating bias. Monitor the collector current of each device with a milliammeter when testing the resistors marked "SOT." I found a value of 390–470Ω yields the desired collector current on each stage. The range is not critical. If the manual specifies 10–12mA, for example, anywhere from 8 to 15mA will do.

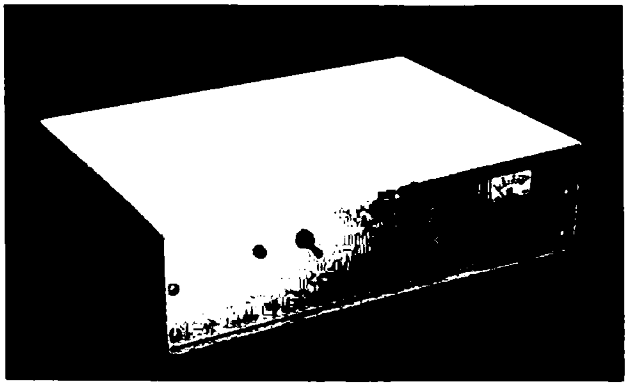


Photo A. The completed 13cm transverter.

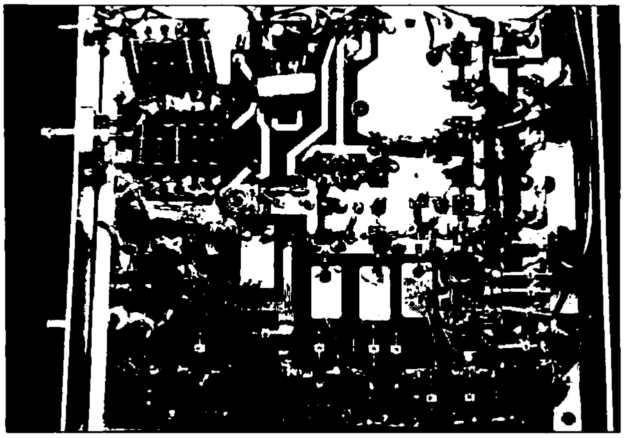


Photo B. Interior view of the transverter.

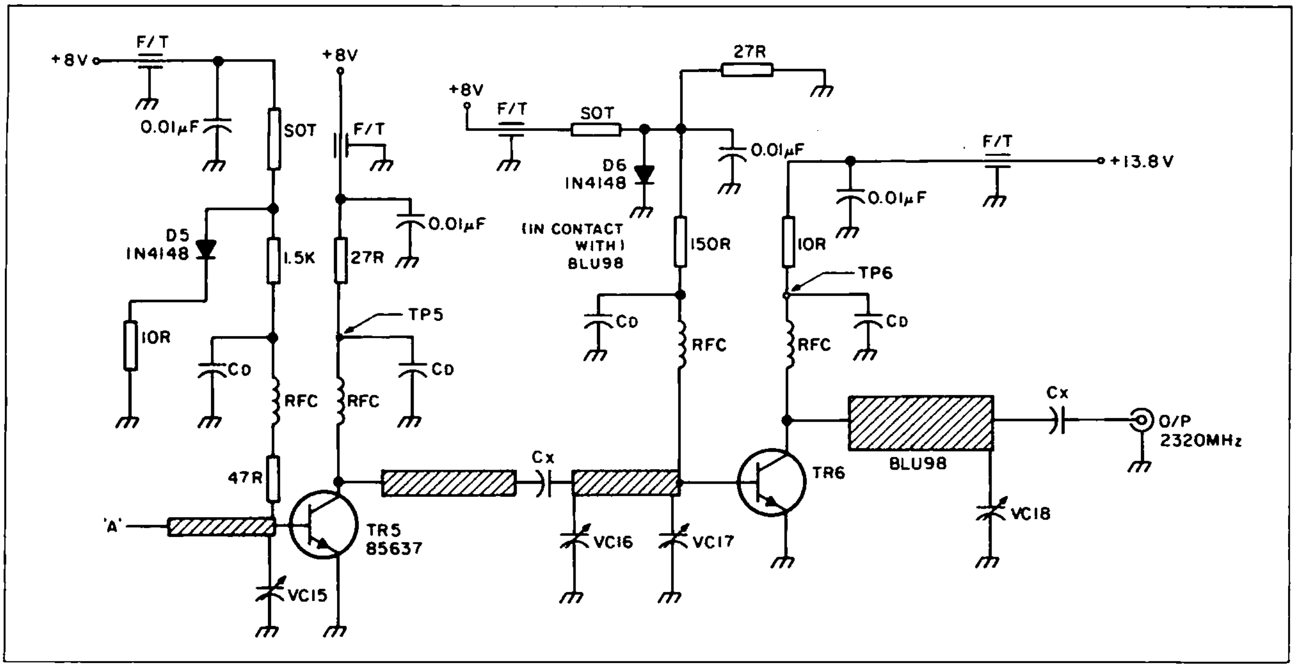


Figure 1. The schematic for the LMW 2304 13cm transverter TX mixer board.

Once the bias has been established for each stage, set up the ring mixer. This is a tough job without a spectrum analyzer or RF probe! Dave Mascaro WA3JUF checked out mine with a analyzer probe, which he also used to roughly align all the gain stages. A spectrum analyzer, however, isn't a must. The builder can still peak up the mixer and gain stages by using an RF probe or absorption wavemeter, both of which are readily found as surplus.

Set the trimmers on TR1 for maximum output by following the pictorial and checking with a probe. Next, connect the probe to each stage and adjust for maximum output while monitoring collector current. Each stage should have output peaks at minimum current values. Distinguish between the LO output and 2304-MHz composite signal by momentarily cutting the 144-MHz drive. The output should drop off completely. If this does not occur, the LO output has been peaked instead of the 2304-MHz signal. In this case, retune the ring mixer. If the output does drop off, the correct signal is present. Continue alignment as before.

Use a good 50Ω load to tune TR6 and carefully monitor collector current. Although the manual claims that 100mA will be the peak value, the stage can go into oscillation and considerably exceed that value! The final alignment of my unit yielded 65–75mA with the drive saturated. I used a Boonton 92 with 2W 50Ω load—not very accurate at 2304, but 50Ω nonetheless.

Use the above scheme to tweak the ring mixer and suppress the 2160-MHz LO signal. Apply power to the board and increase the Boonton 92's sensitivity until a signal is present. This is the LO signal. When I readjusted the trimmers, it dropped almost 10 dB, after which 144 MHz was re-injected and TR2 repeaked. The manual claims 35 dB of LO rejection at 500mW output. With 300mW output, there was an adequate 40 dB of rejection.

Final Assembly

The truly fun part is stuffing everything into a chassis! LMW makes a nice housing for the kit that allows space for the accessory 2-watt amplifier. Photo A shows the completed unit with front panel controls for POWER and TRANSMIT. Red and green lamps respectively indicate the status of these switches. A small Calectro milliammeter monitors final collector current and also displays relative output when the final board is installed.

There are separate connectors for 2304 RX in, 2304 TX out, 144 TR, and DC control and power. I chose the standard 5-pin chassis connector used by Microwave Modules. It's easily found in parts stores and the connectors are quite reliable. A surplus Teledyne relay with SMA connectors takes care of antenna switching, but the Tohtsu 500-series relays[1] with N connectors are probably better choices. These use 13.8 volts instead of the 28 volts needed for the Teledyne.[1]

Operation

The completed transverter was barely ready for the January VHF Sweepstakes. With the barefoot 300mW output into a Down East Microwave 45-element loop yagi atop my roof tower, I gathered 11 contacts in 2 grid squares–not bad at all! N2SB in southern New Jersey, a 40-mile path away, was my most distant contact. Most contacts were on CW, with a scattering on SSB.

Conclusions

The LMW 2304 Transverter kit is an inexpensive way to get a signal on 13 centimeters, but I don't recommend it for the inexperienced builder. Those who know their way around microwave circuitry, however, should find it a snap to assemble and align. All of the boards, especially the ULO, are well engineered. The importer quickly corrected, at no cost, the problem of missing parts and obscure documentation.

The feeling of working that first contact on 2304 after building the kit is unmatched! Those who want to take a plunge on 13cm should give this LMW kit a try.[2]

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[1]Tohtsu 500-series relays are available from Transverters Unlimited, PO Box 6286, Station A, Toronto, ONT Canada M5W 1P3, (416) 759-5562.

[2]LMW Transverters are available as kits or assembled from Down East Microwave, Box 2310 RD #1, Troy ME 04987, (207) 948-3741.

Number 23 on your Feedback card

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Packet QRP

Last month's column looked at some of the digital modes of communications QRPers have at their fingertips. This month's column finishes up digital QRP with packet radio before moving on the phone operation.

Packet radio is so far most at home on the two meter FM band. HF packet is not reliable enough for most people's tastes. I use a TNC (terminal node controller) and a two meter FM transceiver running at two watts output. By using the built-in digipeating capability of the TNC, a packeteer can communicate across the state using QRP power levels. Small portable packet stations will soon become the mainstay of communications during emergencies. Solar energy can power light-weight computers and TNCs. Packet is still quite new, but there are many good books out on the subject, such as *The Digital Novice* by Jim Grubbs K9EI and The *Packet Radio Handbook* by Jonathan Mayo KR3T. Also check out the PacketTalk column in this magazine.

Phone QRP

As much fun as the digital modes can be, they almost always require an interface between operator and radio. Phone operation requires much less—just the rig and the mike! That of course rules out the Heath HW-8 and the HW-9. Ten-Tec's Argosy and Argonaut are super on Single Side Band (SSB), but there are also many other fine SSB radios on the market.

SSB

Working SSB while running QRP can be most interesting. You can find other QRPers running phone on the 3985, 7285, 14285, 21385, and 28885 kHz. There is a move within the Board of Directors of the QRP ARCI for a QRP calling frequency for the Novice ten meter phone bands. When the board settles on a frequency, I'll list it here.

Most important in phone operation is clear, articulate speech. Don't talk very fast. Adjust the audio/mike gain for the best sounding audio. An oscilloscope takes all the guesswork out of setting the controls for the best audio.

Calling CQ while using SSB on QRP is usually a waste of time. Tail-ending a QSO produces far better results. This is the method I use with very good results. Don't forget to check out the other bands. Many times you can find 15 meters open and the DX running but with few stations working the band. Don't overlook the Novice phone band. Ten meters can support some really fine DX openings without the need of QRO (high power).

AM

This is perhaps the oldest form of voice communication. AM phone had its heyday in the early years of ham radio until the 1950s, when SSB came into use. AM is now experiencing a resurgence, however, especially for local to medium distance ragchewing, because of the much more pleasant and realistic sound than one hears on SSB.

Many of the older radios support AM. QRPers who can get their hands on a old Viking, Johnson, Elmac, or Heath DX-100, will be on AM phone with style. Some of the newer, high-tech imports also have AM operation, but they just don't have the punch of the old plate-modulated rigs.

It's true that AM is a high-power mode. There aren't many AM QRPers. There was a lot of AM on the ten meter band several years ago with the use of converted CB radios, and this can happen again with the increasing solar flux. The reader can buy back issues of *73 Magazine* that contain modifications for many different types of CB radios. Amateur radio, however, really needs a good band plan for AM operation on the ten meter band.

It should be possible to amplitude modulate an HW-8 by modulating the PA transistor. Any QRPers want to try? It would be an interesting experiment! A solid state low-level modulator should not be hard to build. Prospective AMers looking for more info can drop a letter to S.P.A.M. (Society for Promotion of AM) F. A. Dunlap, 14113 Stoneshire, Houston, TX, 77060. Send an SASE.

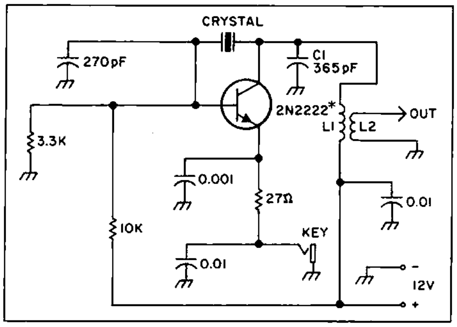

Figure 1. An easy-to-build rig that runs about 500mW input. A perfect project for a rainy day.

PJ0M

DX chasers should keep an eye out for this call. An expedition to Saba Island, manned by 6M DX Society members Mario Karcich WB2CZB, Jim Holt N3AHI, and John Laing W1EXC, has been finalized for 7–14 July 1988. Operation will be on all bands, 80 through 6, SSB and CW will be used. Particular attention will be paid to QRP operators. WB2CZB will be actively soliciting QRP contacts. QSL via Mario K2MUB. (SASEs, please!)

Field Day?

Those not looking for DX may be too busy getting getting ready for Field Day. This column would've focussed on this event, but no one responded to my call for Field day items!

Field Event station W8NP did something different last year. A computer logging system kept track of contacts. That setup proved itself so well that we're going to use it again this year. Forrest Hudspeth WA3FAE wrote it and called it "TestLog." The program is in Microsoft Quick Basic™ and runs on a IBM computer or clone. It has very, very fast dupe checking, error trapping, and error correcting ability. VHF grid collectors can also use this program. The program will hold more than 2000 calls per band!

After going home from Field Day, the contester can load the program up on the home computer and batch-print the entire contest while he bags some much needed sleep.

Interested readers can get a copy of the program directly from Forrest for $20. This price includes all the printer routines and all the docs with which to run the program. This could well be the best $20 a contester ever spent. Drop Forrest a letter at 5883 Woodbine Road, Woodbine, MD, or leave a message on Compuserve (#ID 72126,1173)

More Program Listings

Propagation master Bob Brown NM7M put together the "QRPers Basic Propagation Tool Kit." This is a handbook of propagation hints alone with several small basic computer programs listings. Each program can stand alone, or link together to become a rather slick propagation program. The programs are written in generic Microsoft basic, executable on almost any personal computer.

The tool kit contains 45 pages of text and comes in a 6 x 9 inch book. Copies are available from the QRP Candy Store, Bob Spidell W6SKQ, 45020 N. Camolin Ave., Lancaster, CA, 93534.

Ask for a flyer. The Candy store sells many QRP goodies. (Don't forget the SASE.)

"Milliwatting"

Here's the awaited milliwatt rig. Jim WB2NGN sent this in to me, saying the source was likely from an issue of *73* from some years back. It runs about 500 milliwatts input, and is a very easy "rainy-day afternoon" project to build and get running.

Although the schematic does not show what frequency the transmitter covers, I'd say 40 meters. L1 is 17 turns #24 wire 1¼ inch diameter. L2 is 3 turns link. C1 is adjusted for the best sounding CW tone and best keying. The transistor can take up to 50 mA, so it's best to heatsink it. Also, I have found that the metal 2N2222 gives a bit more bite than the plastic versions. Since the transistor keys on and off by grounding the emitter, use a low resistive keying device. A straight key is fine. An electronic-keyer driven reed relay is also OK.

There is no PC board for this project. Use perf-board or make the small PC board.

The term "milliwatting" is starting to replace the awkward-sounding phrase "QRPp." Running less than half a watt really makes the hair thin. This requires the absolute best antenna system possible, operating style, and every trick in the book, will be needed to catch a QSO.

One last word for those milliwatters out there: "Success grows from the soil of despair!"

WEATHERSATS

View On Video Processing

Dr. Ralph Taggart WB8DQT
602 S. Jefferson
Mason MI 48854

This month's column deals with quite literally the "big picture"—the whole earth to be precise. Following the US and Soviet polar orbiters is a way to gel a very detailed view of the weather in the reader's part of the continent, but it falls far short of viewing the whole earth from space. The sat-chaser can greatly enhance that view by adding WEFAX capability to his station.

Worthwhile Investment

Although early WEFAX experiments involving image relay via geostationary satellites were begun in the early 70s using VHF transmissions, all current WEFAX activity is now conducted on 1691 MHz (plus 1694.5 MHz for the European METEOSAT spacecraft). This requires the addition of some S-band microwave hardware to the station. Since image transmission formats are similar to those used by the VHF polar orbiters, an S-band upgrade can be as simple as the addition of a small dish (typically 4 feet or 1.2 meters in diameter) and a downconverter to convert the 1691 MHz signal down to a standard VHF frequency (typically 137.50 MHz). The *Weather Satellite Handbook* (*WSH*) covers many of the hardware details. There are some very real advantages to having WEFAX capability:

(1) The U.S. GOES and European METEOSAT spacecraft are geostationary, so once the sat-chaser has the antenna aligned on a spacecraft within range, he simply locks it in place and forgets it!
(2) A wide variety of image products, including weather charts, mosaics (polar and mercator) of polar orbit imagery, and samples of GOES imagery, are available for viewing. Over 100 images are contained in the GOES central daily schedule.
(3) All images are transmitted on a fixed daily schedule, making it easy to plan the reception of particular pictures of interest.

The most interesting pictures for most experimenters are the images derived directly from the GOES spacecraft themselves. GOES East and GOES West scan

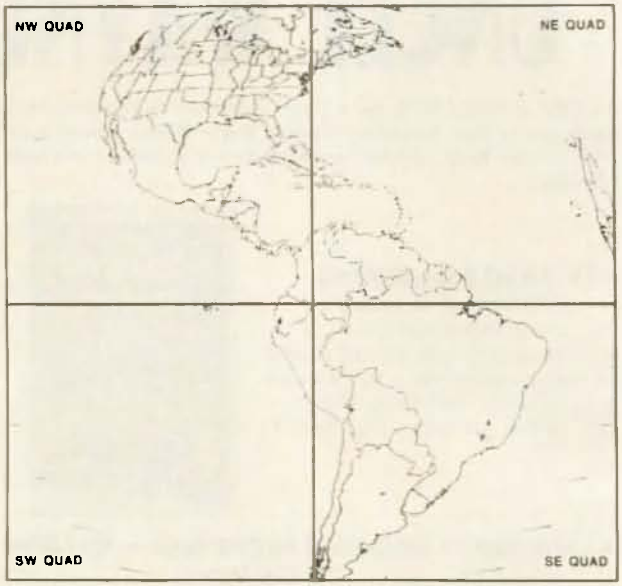

Figure 1. Diagram of the arrangement of WEFAX quads that make up the mosaic of the full earth disc as imaged by one of the GOES spacecraft. This particular diagram shows the coverage from GOES E and is reproduced from Clark, R.M. and E.W. Feigel. 1981. The WEFAX User's Guide. Nat. Earth Sat. Serv., NOAA, U.S. Dept. of Commerce.

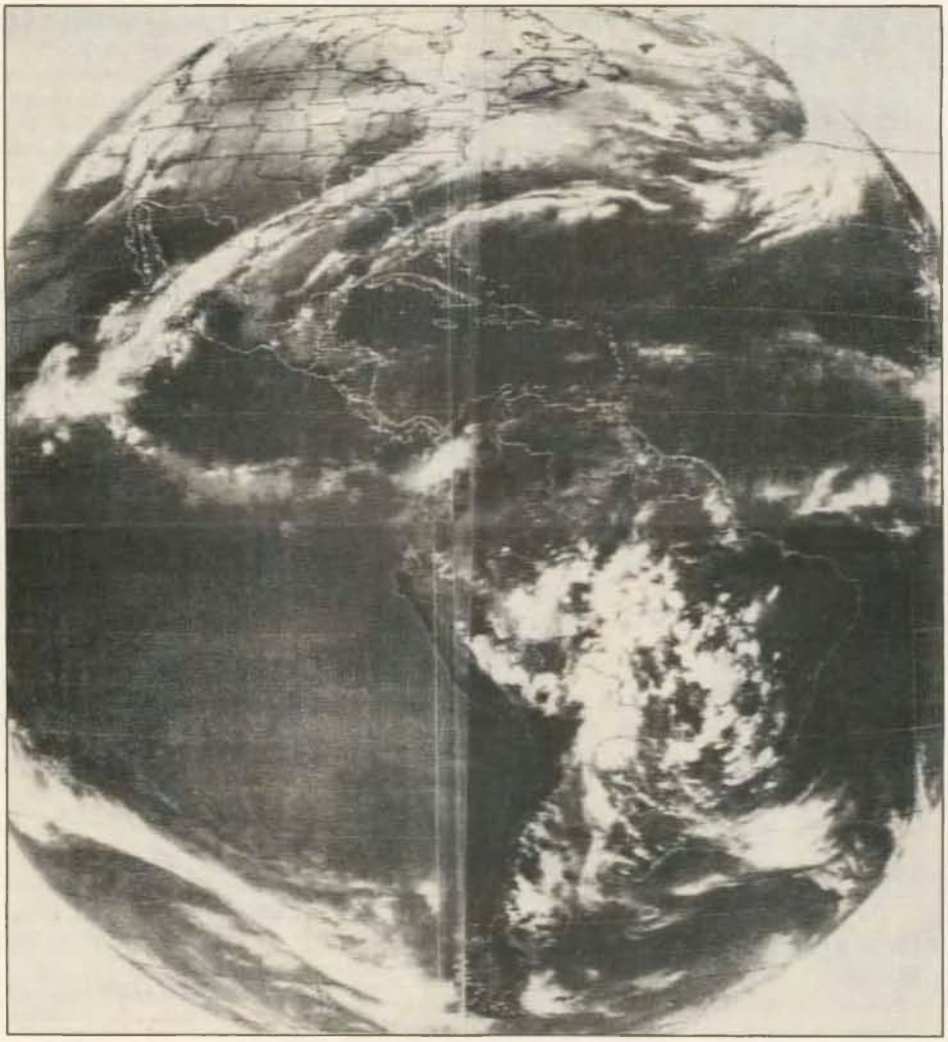

Figure 2. Manual assembly of prints of individual quads is the standard way to reconstruct the earth disc. This example shows an 1800Z IR image derived from GOES E and transmitted through GOES Central. Although this procedure is simple, it takes time, uses up four sheets of FAX paper, and the resulting image is too large for convenient storage! This image was prepared from four Smartfax prints from the scan converter video memory. Each quad represents 768 image lines, each line digitized to 1024 pixels. All of the examples shown here are late December (1987)/early January (1988) IR with plenty of nasty winter weather in northern North America.

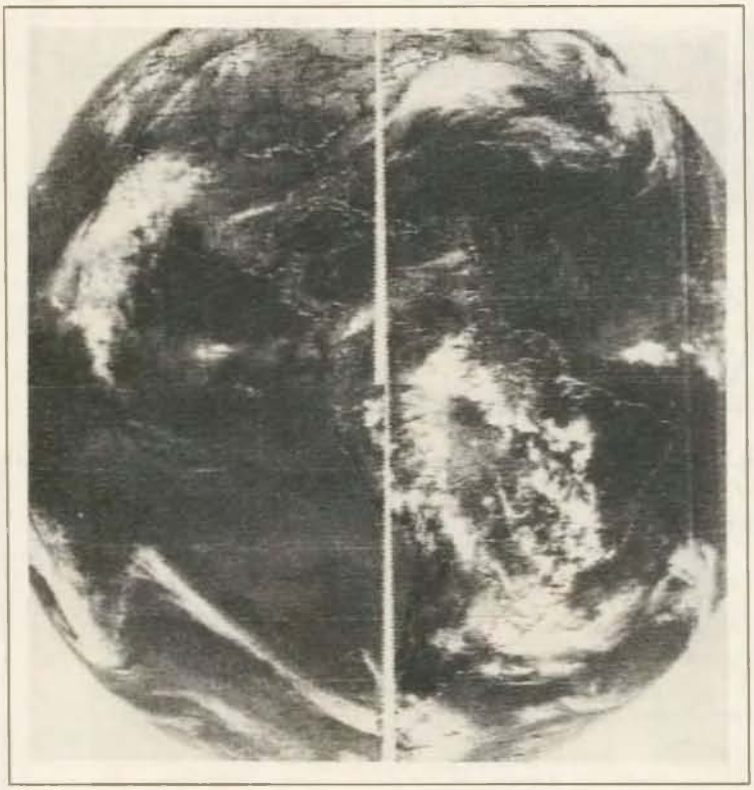

Figure 3. The first attempt at electronic assembly of the disc image. While the software routines worked just fine, a slight clock error prohibited merger of eastern and western quad pairs.

the entire earth disc every half hour and transmit the highly detailed, multispectral images back to earth in a wide band digital format. These digital signals are transmitted back through the originating spacecraft in a time stretched format to reduce the required bandwidth, but it requires quite a sophisticated ground station to receive, decode, and display these digital images. A number of dedicated experimenters have accomplished this formidable task, but such installations are still out of reach for most satellite hobbyists.

Good News

Fortunately, the images of the earth disk are available, at reduced resolution, via WEFAX transmissions through the primary imaging spacecraft and via GOES Central, which is dedicated entirely to WEFAX relays. The NOAA ground computers, which digest and format the detailed digital images, are also used to format the earth disc imagery for WEFAX transmission. The primary format involves breaking the earth disc up into four quadrants: NE, SE, NW, and SW (see Figure 1) which are transmitted in sequence.

The WEFAX format is quite easy to process. The *WSH* scan converter, for example, operates automatically in the WEFAX mode, displaying each picture as it comes in. This is a rather neat way to observe the many WEFAX images that are transmitted—just watch them instead of using up film or paper. The viewer inevitably gets the itch to put those four quadrants together to see what the entire earth looks like. To do so, he has to print each image quadrant (using a FAX printer) or photograph and print each one (if he is using a CRT display system). With hardcopy of the four quads in hand, the rest is just manual labor. Each quad overlaps its neighbor by just a small amount, so the four images can simply be overlapped slightly to reconstruct the earth disk image.

The whole process gets a bit tedious and time consuming, but the results are often spectacular, as shown in Figure 2. Aside from the time required to prepare the disc mosaic, there are a few other factors that interact to reduce the number of such pictures the viewer is likely to construct:

(1) He must print out each of the image quads. Each disc requires at least four sheets of FAX paper.

(2) Phasing must be very precise. If he loses a portion of one or more quads, a good match up may be impossible

(3) The contrast for each of the quads must be identical. Tonal variations between quadrants detracts from the appeal of the image.

(4) The resulting images are quite large since they represent four normal prints. The *WSH* FAX recorder prints images that are approximately 7 inches square, so the final disc image will be almost 14 × 14 inches. This is fine for hanging on the wall, but the pictures are difficult to store, not to mention the bill for FAX paper!

The use of the scan converter eliminated some of the problems in that succeeding WEFAX images could be registered laterally with an error of less than 0.1% (under 1 pixel displacement error in a 1024 pixel line) and line registration is virtually perfect. At a given contrast setting, tonal variation from quad to quad is unnoticeable, provided the NOAA computers do their job properly!

Figure 4. A complete rewrite of the software to compensate for any reasonable clock errors resulted in an essentially perfect merge of the quads. In addition to being able to preview the disc image using the scan converter, hardcopy printouts now only require a single sheet of FAX paper and the print is easily filed away. Each quad in this image consists of 384 image lines, each digitized to 512 pixels, resulting in a total of 768 lines for the composite with 1024 pixels per line. This image is a Smartfax print directly from the scan converter video memory.

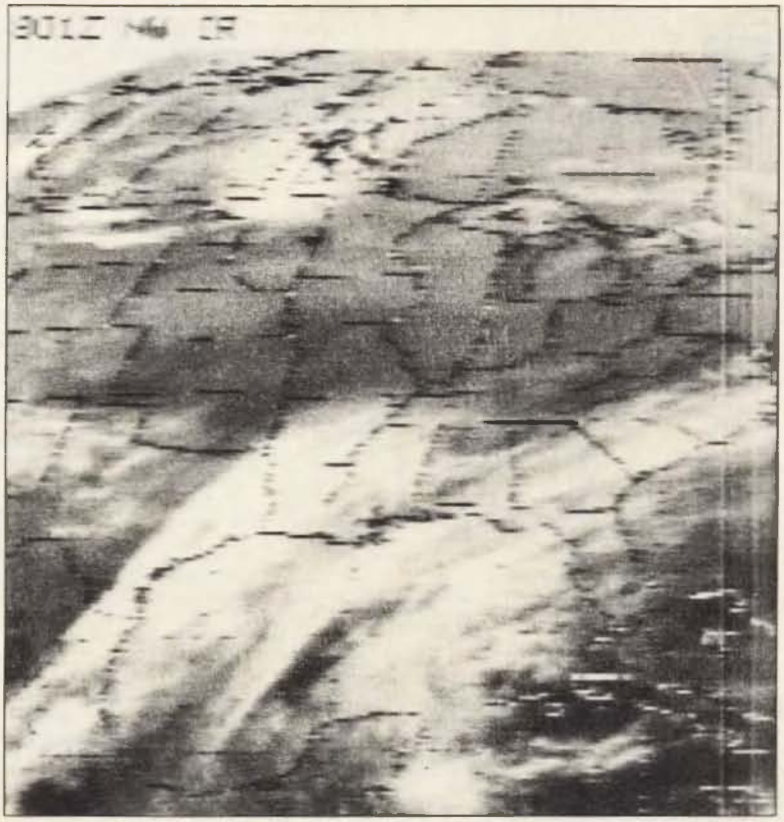

Figure 5. Although quad resolution must be reduced to fit the full disc into memory. resolution is still acceptable as shown by the Smartfax print of a high resolution zoom into the image memory. State boundaries are recognizable, cloud features are reasonably detailed, and the image even shows the waters of Lake Michigan to be warmer (darker) than the surrounding land surface. The area of this high resolution zoom represents about 1/16th of the total image area.

Smart Idea

The development of the simple Smartfax recorder (see WEATHERSAT for September and October 1987) made it quite easy to print pictures directly from the scan converter memory and that, in turn, made it a bit easier to prepare full-disc mosaics. In the case of Figure 2, the original quad transmissions were taped and each was automatically loaded in turn into the scan converter memory. A Smartfax print was made of each quad and then the prints were trimmed and fitted together to prepare the mosaic. It still took time and paper, the pictures were still too large to handle or store easily, and the taped junctions between quads were more visible than I really liked, but it was an improvement over direct FAX printing.

After printing out a number of disc mosaics in that way, despairing of rising paper costs, I considered letting the computer do the job using the scan converter. Normal scan converter operation involves sampling each line by 1024 pixels and loading 768 of these lines to the image memory (380K). If the sampling density were dropped to 512 pixels per line and each quad were limited to 384 lines (sampling every other line), each quad would occupy ¼ of the total image memory. In theory at least, if the quads were properly loaded to the correct part of the memory, the final image would consist of the proper arrangement of all four quads—basically the entire earth disc!

Having gotten that far, I decided to carry through and develop a new WEFAX mode to properly assemble the quads automatically. Setting the revised sampling rates was easy, as was the problem of proper placement in memory, but there were additional programming challenges I had not adequately anticipated.

Programming Hurdles

A child can do the manual preparation of mosaics, which involves the trimming off of extraneous border material from each print and fitting together the four quads. The computer, however, is an absolute dunce by comparison. The electronic trimming and fitting turned out to be a major programming task that required many hours of measuring and calculation of the limits of extraneous border and the horizontal and vertical overlap of quads, all in terms of pixel counts.

Figure 3 shows the first attempt at electronic quad assembly. The quads were all in the right place and the joining of northern and southern quads was fine, but the image showed those nasty white wedges between the eastern and western quads! The problem was a slight error in the master clock frequency, tilting each image just enough to make east-west merge impossible. Getting the clock *precisely* on frequency would solve the problem, but I chose to completely redo the programming so the quads could be merged even with noticeable clock errors.

"Holding the full disc at full resolution would require over 1.5MB of RAM!"

Perfection At Last

Since a lot of reprogramming was necessary in any case, I decided to refine the software to completely eliminate the border material and place the disk on a blank background for the most pleasing appearance. The final result of this programming effort is shown in Figure 4 and features a virtually perfect merge of the four quads.

In addition to the convenience of being able to view the whole disc on the TV monitor, the image can be printed via Smartfax using just a single sheet of paper! While manual assembly of a disc almost always requires the use of tape recordings of the quad transmissions, this is not true of the software assembly. It works so well that I can set up the station system to input the sequence of quads into the scan converter directly from the receiver so that the 1800Z earth disc can be waiting for me when I get home!

The only disadvantage is that one has to reduce the effective resolution of each quad in order to fit all four into the 380K video memory. Holding the full disc at full resolution would require over 1.5MB of RAM! The reduced resolution, while noticeable, is not really too serious, balanced against the spectacular view. Figure 5 is a Smartfax print of a high resolution zoom into the disc image. While bro- ken up a bit, all the state boundaries are still recognizable and cloud features adequately detailed. Those hams who want to look at the whole world's weather should try upgrading to WEFAX! 73

References

References to the *WSH* refer to the Third Edition of the *Weather Satellite Handbook*, available from the columnist for $15. Outside of the US, please include an additional $1 for postage.

Ed note: We encourage the exchange of weathersat ideas and software on the 73 BBS. Call 603-525-4438 (300/1200 baud) and sign on.

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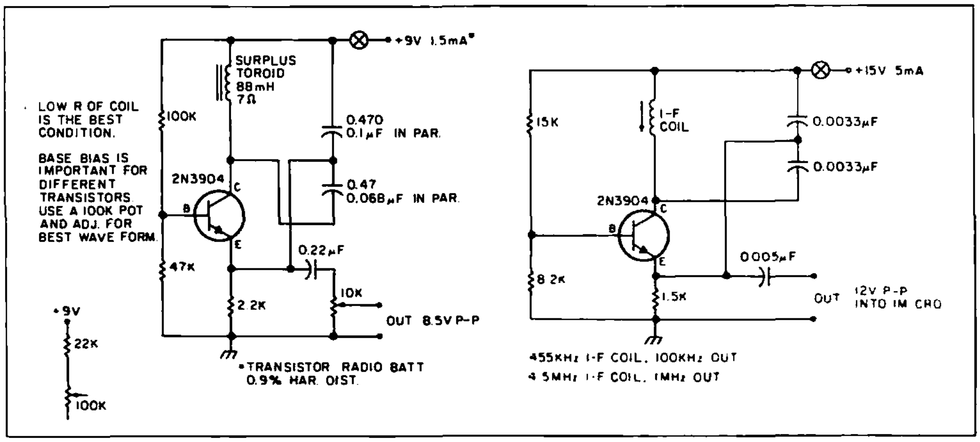
Circuits

Great Ideas From Our Readers

Have a quick'n'easy circuit idea? Share it and get a one year subscription or extension to 73! Clearly mark all entries as submissions for Circuits to distinguish them from manuscripts. Send your entries to Circuits, 73 Magazine, Peterborough, NH 03458.



SIMPLE OSCILLATOR CIRCUIT

It occurred to me that some of my fellow hams might be interested in a simple oscillator circuit that I have used for years.

Almost any NPN transistor will work, but the base bias should be varied for each transistor. Characteristics vary a great deal. Also the lower the resistance of the inductance, the better the circuit will work. If the resistance is too high, the circuit will not oscillate.

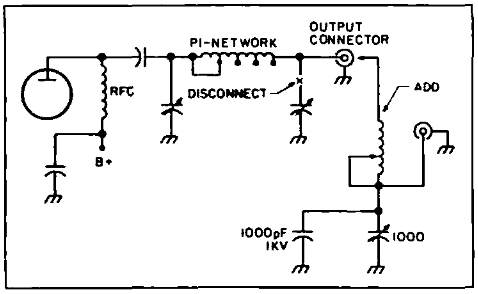
The figures show the versatility of the circuit.

L.C. Pochop W6LBH
Ontario, CA

ADD 160 METERS TO YOUR AMPLIFIER

If your amplifier has a tube-type pi-network output circuit, it should be an easy job to add our lowest frequency band to its coverage. Either adjust the output capacitor to minimum or disconnect it. Add an external coil (about 2-inch diameter and 4-inches long and 8 turns per inch) and 2000 pF capacitance. Partly variable. Adjust to resonance using your dummy load and reduced drive level.

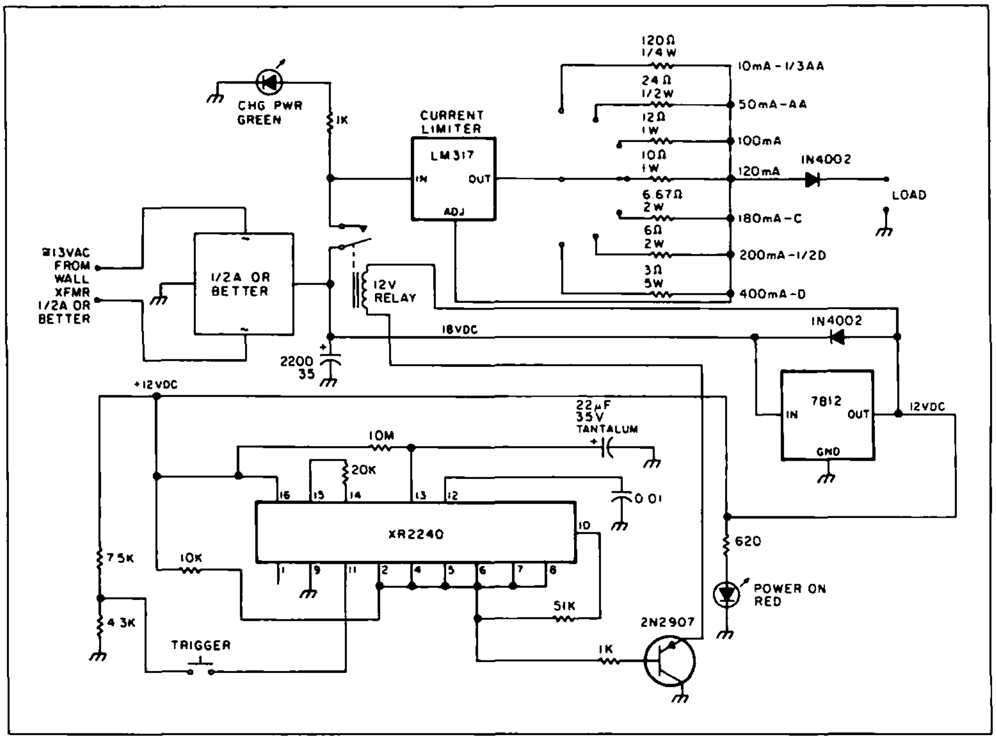
Robert L. Larson W7LNG
Medford, OR



SELECTABLE NiCd CHARGER

This unit was originally built to charge cells "rescued" from bad battery packs. It is much better to slow charge NiCds. There is always the danger of forgetting to remove the cells from charge at the appropriate time, so a timer was incorporated. With the normal tolerance of tantalum capacitors, the timer should time out between 15.5 and 17 hours. The relay used is a sma'l low current relay. A surplus 13.5 VAC 750 mA wall transformer is used as the AC source and a one amp bridge was used to recitify it. The resistors were made up of stock units in series or parallel to make up the proper value, checked with a DMM.

R.R. De Jongh WB7CPT
Bellevue, WA



Number 26 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

HOT DX!

June has several interesting characteristics including the longest day of the year; the greatest amount of potential ionization; and the longest band openings from our part of the world to DX locations. It is also the month when VHF opportunities abound. The general conditions for DX are expected to be good for the first ten days of the month, fair to poor for the next ten days, and fair to good for the last ten days. The daily forecast will indicate the days on which the magnetic field is expected to be unsettled (F), to active (P). DX will not be as good as it was in March—April, or as good as it will be in September—October, but the sunspot numbers and solar flux values are climbing, so good openings may occur. In particular, look for the gray-line DX along the darkness path at dawn and dusk, since signals can be excellent at these times.

The best days for any DX path, particularly the difficult ones, is when the solar flux rises to about 100 or more, and the magnetic field is quiet (G). The A and K indexes for the day and the solar flux, may be found by tuning in to WWV at 18 minutes past each hour. Because WWV gives data for the previous day and the expected data for the following day, plot trends may be made.

Bear in mind that daily forecasts may vary one way or the other, by a day or two. Sometimes the sun and magnetic fields don't behave as predicted at all, that makes propagation forecasting as much an art as science!

JUNE

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F–G	2 G	3 G	4 G
5 G	6 G	7 G	8 G	9 G	10 G	11 F
12 F–P	13 F–P	14 P	15 P	16 P	17 P	18 P–F
19 F	20 F–P	21 P	22 P–F	23 F	24 F–G	25 G
26 G	27 G–F	28 F	29 F–G	30 G		

EASTERN UNITED STATES TO:

GMT:	00	02	04	08	08	10	12	14	10	15	20	22
ALASKA	--	--	--	--	--	--	20	--	--	--	--	--
ARGENTINA	20	20	20	40D	40D	--	--	--	--	--	10	15
AUSTRALIA	--	--	--	20	20	40D	20D	20D	--	--	--	--
CANAL ZONE	15	20	20	--	--	--	20	20	20	--	10D	15
ENGLAND	20	--	40/80	40/80	--	--	--	--	--	20	20	20
HAWAII	15D	20	20	20	40D	40D	--	--	--	--	--	15D
INDIA	20D	20D	--	--	--	--	--	--	--	--	--	--
JAPAN	--	--	--	--	--	--	20	--	--	--	--	--
MEXICO	15	20	20	--	--	--	20	20	20	--	10D	15
PHILIPPINES	--	--	--	--	--	--	20D	--	--	--	--	--
PUERTO RICO	15	20	20	--	--	--	20	20	20	--	10D	15
SOUTH AFRICA	--	40	40	20D	20D	--	--	--	--	--	20D	20D
U.S.S.R.	20	20/40	20/40	--	--	--	--	--	--	--	20	20
WEST COAST	40	80	--	--	--	--	--	20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT:	00	02	04	08	08	10	12	14	10	15	20	22
ALASKA	--	--	20D	--	--	40D	--	20	--	--	--	--
ARGENTINA	20/40	20/40	20	40D	--	--	--	15	15	15	15/20	20
AUSTRALIA	15D	20D	[illegible]	20	20	40D	20	20	--	--	15D	15D
CANAL ZONE	20	20	20	40D	40D	--	20	20	15/20	15	10D	10
ENGLAND	20	--	40D	40D	--	--	20D	20D	--	--	20	20
HAWAII	15	15	20	20	20	40D	20	20	--	--	--	15D
INDIA	20D	20D	--	--	--	--	20D	20D	--	--	--	--
JAPAN	--	--	20D	--	--	40D	--	20	--	--	--	--
MEXICO	20	20	20	40D	40D	--	20	20	15/20	15	10D	10D
PHILIPPINES	--	--	--	--	--	--	20D	20D	--	--	--	--
PUERTO RICO	20	20	20	--	--	--	20	20	15/20	15	10D	10D
SOUTH AFRICA	--	--	40D	20D	20D	--	--	--	--	--	--	--
U.S.S.R.	--	--	--	--	--	--	20D	20D	--	--	--	--

WESTERN UNITED STATES TO:

GMT:	00	02	04	08	08	10	12	14	10	15	20	22
ALASKA	--	--	--	20	20	20D	40D	20D	20D	--	--	--
ARGENTINA	15	20D	20	20	--	--	--	20	--	--	--	15
AUSTRALIA	15	15	15	20	20	20/40	40	20/40	--	--	--	--
CANAL ZONE	10D	15	20	20	40D	40D	--	20	20	--	15	20D
ENGLAND	20	20	20D	--	--	--	--	20D	--	--	--	20D
HAWAII	15	15	[illegible]	20	20	20/40	20/40	--	20	--	15D	15
INDIA	--	--	20D	20D	--	--	--	20D	20D	--	--	--
JAPAN	--	--	--	20	20	20D	40D	20D	20D	--	--	--
MEXICO	10D	15	20	20	40D	40D	--	20	20	--	15	10D
PHILIPPINES	--	--	--	20D	20D	--	--	20D	20D	--	--	--
PUERTO RICO	10D	15	20	20	40D	40D	--	20	20	--	15	10D
SOUTH AFRICA	--	--	--	20D	20D	--	--	--	--	--	--	--
U.S.S.R.	20D	20D	20D	--	--	--	--	20D	--	--	--	--
EAST COAST	40	80	--	--	--	--	--	20	20	20	15	40

The band openings are for June, July and August. Note that a (D) will indicate a difficult path. Try on days when the geomagnetic field is quiet (G) and when solar flux is 100 and greater.

Tropospheric Propagation

Summer usually brings with it enhanced propagation conditions for the VHF and UHF bands. Most of the weather occurs in the lower portion of the atmosphere, or troposphere, and many times certain weather will support VHF/UHF propagation over hundreds of miles, well beyond normal line-of-sight.

Atmospheric conditions can bend radio waves, just like they affect light to create mirages and other optical illusions. In the case of radio signals, the distribution of water vapor has a dominant effect on tropospheric propagation. Water vapor content, atmospheric pressure, and temperature all determine the atmosphere's index of refraction, n, which is a measure of air's transmission characteristics. In particular, $n = 1 + N \times 10^{6}$, where N is called refractivity. Refractivity is calculated by $N = (77.6P/T)+(4810e/T^2)$, where P is atmospheric pressure in millibars, T is temperature in degrees Kelvin, and e is the water vapor pressure in millibars.

When all of these variables change quickly as a function of height, or when the atmosphere is layered as in the case of a cold or warm front, tropospheric propagation can be very favorable. In fact, if n changes very sharply, say within the lower 500 feet of the atmosphere, signals can become trapped in a tropospheric "duct." Ducts can even support microwave propagation over distances of 1000 miles or morel

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
2310 Romayor Court
Pearland TX 77581

Spaceborne Bits

Amateur satellites and *73*'s theme this month, digital communications, have much in common. Excluding CW telemetry, digital hamsat-generated transmissions began with AMSAT-OSCAR-7. This satellite used RTTY as an alternative to CW for communicating its vital signs to control stations on earth. There's been a rapid move to high-speed ASCII and packet since this beginning in the early seventies.

AMSAT-OSCAR-10 used PSK (Phase Shift Keying) at 400 baud as the primary downlink of telemetry. This speed and format is also incorporated in the system on board Phase 3C. Only a few stations around the world are designated for ground control of the satellite's functions. Before the memory on A-O-10 gave out, these stations were able to leave short messages for each other via specially designated parts of the telemetry data stream set aside for this purpose. It worked well as a limited form of store-and-forward communications.

The UoSAT series have provided many with an opportunity to experiment with automatic data capture and telemetry decoding using mainly 1200 baud ASCII. With several passes a day from two satellites, UoSAT-OSCAR-9 and UoSAT-OSCAR-11, it's easy for interested hams to find orbits that fit their operating schedules.

Store-and-Forward

In addition to the telemetry and bulletins, UoSAT-OSCAR-11 provided the first amateur satellite store-and-forward system for use by hams not actively involved as ground control stations. This DCE (Digital Communications Experiment) on U-O-11 has allowed global communications for designated stations active in the experiment and others with packet connection to them. The DCE shares downlink frequencies with the beacon and uplink frequencies with satellite command channels, so access must be limited.

Gateway stations have been created to allow other amateurs to pass messages through the system. These stations collect traffic from local and regional packet systems and send the messages to the satellite while downloading messages for local distribution. Harold Price NK6K in Redondo Beach, near Los Angeles, is one of the U.S. stations set up to forward traffic through U-O-11.

In August of 1986, Fuji-OSCAR-12 became amateur radio's first packet radio satellite available for general use. Although power budget problems prevent long continuous operation, this offering from the cooperative efforts of the Japan Amateur Radio League, JAMSAT and NEC, may be used by any licensed amateur with the desire and equipment needed to do the job. Due to the special equipment requirements, there aren't many stations using this resource. This is both good and bad.

Two-sided Coin

On the good side, it keeps activity to a manageable level. The satellite can only handle a limited number of "connected" stations at a time. Imagine the confusion of a single digipeater with most of the United States able to hit it via line-of-sight. If this "digi" only provided bulletin board service most of the time like F-O-12, any reasonable communications would be uncontrollable, since everyone on the system simultaneously attempts to upload messages and read replies.

The bad news is that for many, F-O-12's digital transponder is too much effort for too little return. Look back to the August 1987, Hamsats column. A station minimally equipped for F-O-12 Mode JD (the digital mode) will have two-meter FM with reasonable antennas or power or both; 70cm sideband receive capabilities; with an automatic circuit for Doppler correction of the downlink frequency during the pass; a PSK modem hooked to a packet radio TNC (Terminal Node Controller); and a computer. Other niceties that make the system more manageable include an automatic computer-driven rotator system and high-gain circularly-polarized antennas with power and preamplifiers. It is also useful to have a way to capture all of the activity on a pass via recorder, disk storage or paper print-out.

A few hundred hams around the world have put the pieces together, but for others, the wait for packets from space continues.

P3C's New Offerings

With the launch of Phase 3C, a new form of packet radio experiment from orbit will begin operation. Although access won't be limited to select stations, the equipment requirements will keep away all but dedicated enthusiasts.

RUDAK (Regenerating Transponder for Digital Amateur Communications) uses 1269 MHz 2400-baud PSK for the uplink and 400-baud PSK on 435 MHz for the downlink. The exact frequencies are shown in Table 1. A complete RUDAK earth station will start with a PSK modulator; two-meter transmitter set up for the necessary bandwidth to handle 2400 baud; and a two-meter-to-24cm transmit converter with power amplifier. For receive, any good 435 MHz multi-mode rig will do. The antenna for 24cm should be at least a 45-element loop Yagi or a four-foot dish with circular feed. An 18-element crossed Yagi with preamp will work well on 70cm.

The heart of the system includes a computer, or terminal, and a modified TNC2 (or clone) with an appropriate demodulator connected to the modem disconnect jack inside the TNC. Like the F-O-12 modems, nothing is available in commercial form prior to launch and subsequent proof that the system works in orbit. Empty circuit boards from AMSAT DL in West Germany or AMSAT UK in England can be purchased for those who can't wait.

It will require serious effort to build a complete system. The majority of RUDAK users will likely be European satellite/packet experimenters until competitively-priced 24 cm radios and appropriate modems can be bought or constructed from kits available here in the states.

Mode B:	Uplink:	435.420–435.570 MHz
	Downlink:	145.975–145.825 MHz
	General Beacon:	146.812 MHz
	Engineering Beacon:	145.985 MHz
Mode JL:	Uplink 1:	1269.620–1269.330 MHz
	Uplink 2:	144.425–144.475 MHz
	RUDAK up:	1269.710 MHz
	Downlink 1:	435.715–436.005 MHz
	Downlink 2:	435.990–435.940 MHz
	RUDAK down:	435.677 MHz
	General Beacon:	435.651 MHz
Mode S:	Uplink:	435.601–435.637 MHz
	Downlink:	2400.711–2400.747 MHz
	Beacon:	2400.325 MHz

Table 1. Revised Phase 3C Frequency Plan

The Next Generation

A third UoSAT spacecraft, UoSAT-C, is currently under construction at the Engineering Research Unit at the University of Surrey in England. It is scheduled for launch as early as the end of this year on a Delta launch vehicle. The orbit will be circular and 500km high with a 43° inclination.

Among the many experiments on board is PCE (PACSAT Communications Experiment). Using a Mode J style system with two-meter uplink and 70cm downlink, the PCE will be available for amateur radio use, while additional frequency allocations may be used by VITA (Volunteers in Technical Assistance) outside the amateur bands. VITA activities will focus on message store-and-forward from remote areas to provide technical assistance and disaster relief. Access will be much easier since the system will use FM up and down with standard TNC's and no external modems.

In a recent demonstration of the potential of a LEO (Low Earth Orbit) packet satellite operation to U.N. officials, AMSAT NA President, Rip Riportella WA2LOQ used a complete station carried in an attache case. With external ground-plane antennas in place, the station could be used for reliable and portable satellite communications through a future PACSAT. Such a system would be used primarily for emergency use from remote locations.

Companies supporting the demonstration included Radio Shack with a new model laptop computer, Yaesu with the latest miniature HT's, and Tasco of Japan with their new ultraminiature TNC, the size of a cigarette pack. The day for easy satellite packet operation may come soon.

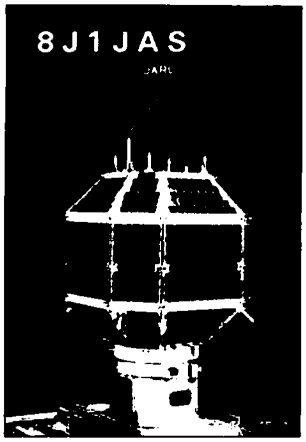


Photo A. Fuji-OSCAR 12 QSL card.

QSLs Available

For those who have listened to or operated through F-O-12, the JARL has a very nice full-color QSL available tor a reception report ol the downlink telemetry. A sample is shown in Photo A. Send to the JARL, 1-14-2 Sugamo, Toshima, Tokyo 170, Japan.

The University of Surrey has QSL cards for reception reports of U-O-9 and U-O-11. A U-O-11 card is available by sending a detailed report of digitalker reception during the Skitrek/Project Nordski Comm operation to: UoSAT Spacecraft Engineering Research Unit, University of Surrey, Guildford, Surrey GU2 5XH, England.

Field Day

June is Field Day month and a satellite station in the woods or out on the beach is great fun. Satellites available for use this year may include RS-10/11, A-O-10 and F-O-12.

For RS-10/11 a simple station should do the job, but don't cut corners. With the transponder full of stations looking for the bonus points for a satellite QSO, those with only a few watts to quarter-wave whips will have trouble getting a complete exchange through. For two-meters, use a small to moderate beam, and on ten meters a dipole will work fine. Hopefully, the satellite will be in Mode A only, since simultaneous Mode K operation, with its 15-meter uplink, will put a lot of earth-bound Field Day participants unwittingly in the transponder passband. Watch out for generator noise, the HF stations nearby, and take along a preamp.

AMSAT-OSCAR-10 should be in full sunlight by the end of June. Check the AMSAT nets for the latest schedule of operation. The satellite experiences a little eclipsing on almost every orbit in 1988, so strict adherence to posted schedules is important to preserve the batteries. Antennas for this satellite are not quite as portable compared to an RS-10/11 arrangement. A 14- to 20-element crossed Yagi with preamp for the Mode B two-meter downlink, and 25 watts to a 16- or 18-element crossed Yagi on 70cm should be sufficient. Some hams have made several contacts on Field Day with much less, but usually with a very experienced satellite chaser operating the station.

For F-O-12, the antennas used for A-O-10 will do the trick, but that's assuming that the satellite is available for Mode JA, the analog transponder mode, for Field Day. Last year the satellite was scheduled for JD operation for the duration of the outing.

Get your club or group involved with a satellite Field Day station. It does not count as a transmitter in the final tally, yet it can make a lot of points if conditions are right. It is also a fine opportunity to demonstrate the fun of hamsat activity.

Launch and Orbit
Launch at: 20:45. 12 August, 1986 UTC
Launch by: NASDA, with H-I rocket
Launch from: Tanegashima Space Centre, Japan
Orbit: circular, altitude ol 1500km
Period: 116 minutes
Inclination: 50 degrees

Construction
Weight: 50kg
Configuration: polyhedron of 26 faces covered in solar cells
Size: 400mm (dia) X 470mm (height)

Antennas
Receiving: A quarter Wave slanted monopole at the top of satellite
Transmitting: A turnstile at the top for analog signal, and a turnstile at the bottom for digital signal; both radiate circular polarized wave.

Power
Solar array: output 8.5W, n/p silicon 2cm X 2cm
Storage Battery: NiCd, 6AH

Table 2. Major Specification of JAS-1

Number 28 on your Feedback card

TECH TIPS

PC-Board Fabrication

W.C. Cloninger's article, "EZ PCB's," was very interesting (*73 Amateur Radio*, August 1987). TEC-200 film is unquestionably the easiest of several PC board processes that I have tried, but it does have its limitations. I would like to share some of my PC-board fabrication experiences with other readers.

Be aware that thermal expansion of TEC-200 film while transferring an image to the copper surface tends to spread or smear the pattern. This effect is small and does no harm in most cases but could be a problem with large boards, especially those with very fine traces.

A far more serious problem is size change when photocopying. Most office photocopiers don't make copies that are exactly 100 percent of the original size and of course the error is doubled when making a reversed image. I had to discard some etched and drilled boards because the holes didn't even come close to matching pins on a long connector. Check dimensions on the final film before proceeding with the remaining steps. If the error is too large, try another copy machine.

With regard to etching, the author alludes to warming the etchant to speed up the process. As a matter of fact, heating the etchant to 90° to 115° is mandatory to achieve advertised etching times. I used a 250 watt heat lamp about 12 inches above the tray.

Continuous agitation to bring fresh etchant into contact with the copper is also essential. A motorized tray rocker is handy (though not essential) and numerous designs have appeared in amateur radio publications. Experimenters who make many boards may want to build a bubble etcher for even greater efficiency. Jim Stinson has described an easy-to-build etcher that utilizes a plastic refrigerator box and an aquarium air pump in *QST*, November 1984, page 45.

Finally, don't "push" the etchant too far. Depleted etchant works slowly and produces poor results. For tray etching of average to large size boards, I use just enough etchant to cover the board and discard it after a single use. This procedure may be modified when making several small boards or for bubble etchers, which generally require a larger volume of etchant.

Experimenters should not feel intimidated by these comments. Printed circuit board fabrication isn't as difficult as it might appear and TEC-200 film is an excellent way to get started. Proceed carefully, making corrections if needed, and you're likely to turn out a perfect board on your very first attempt.

Scott Hofer N7DFR
Federal Way WA

Flashlight Battery Hazard

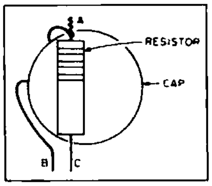
Recently, an individual replaced the 1.5 volt, D-size batteries in a flashlight. The batteries were of two different brands and types (one general purpose and one alkaline battery). The flashlight was checked for operation and issued for use. Ten minutes later a worker returned the flashlight as inoperable. The inoperable flashlight was placed aside and a new flashlight issued. Twenty minutes later, the inoperable flashlight was checked for condition. The handle was too hot to hold and nearly burned the individual handling the flashlight. The individual then used a cloth to empty the batteries into a metal container so as not to damage the counter top. The plastic covering of the alkaline battery began to melt and was too hot to handle for 1.5 hours. The incident was reported to wing safety of an AF Form 457, Hazard Report.

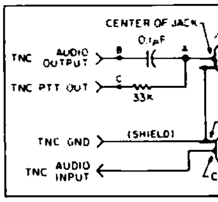
Investigation of the incident found a warning on the alkaline battery which read: "Do not dispose in fire, recharge, put in backwards, mix with used or other battery types. May explode, leak or cause personal injury." The incident was caused by the mixing of two different types of batteries. Alkaline and rechargeable batteries (nickel-cadmium) should always be used by themselves.

Normally, general purpose (carbon-zinc) and heavy duty (zinc chloride) batteries may be mixed together in the same flashlight or electronic component (portable radio, tape player, etc.). However, alkaline and rechargeable should always be used alone and never mixed with any other type of battery. Mixing of either ol these two types of batteries could cause a hazard. For example, if a rechargeable battery and an alkaline battery is used in a flashlight, the rechargeable battery will probable lose its charge first. This may cause the alkaline battery to reverse its charge or leak.

The alkaline battery is an extremely powerful battery and should be handled carefully following the manufacturer's instructions for the battery and the equipment being powered by the battery. If the spring in the battery compartment should tear the protective coating of the battery, it could cause the battery to short out and overheat. An alkaline battery that overheats can reach a temperture of 200 degrees Fahrenheit, which could cause burns when handling. For this reason, alkaline and rechargeable batteries should be handled carefully at all times.

Craig Bledsoe K4TXK
Fairbanks AK





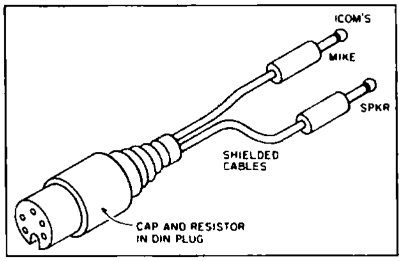


Fig. 1. (top left) How to configure the circuit parts for "Connecting Circuit" to fit inside the DIN plug.
Fig. 2. (Top right) Circuit to interface the PK-232 with the IC-02AT.
Fig. 3. (bottom) The patch cord connecting the PK-233 with the 02-AT.

A Quick HT Holder

An inexpensive dashboard mount for handheld transceivers can be made by attaching a colonial-style strap-iron drawer pull to the top of the dashboard with screws. Bend the ears slightly to compensate for the slant of the dashboard padding. Hook the HT's belt clip over the handle.

Screw a small cabinet hook to the dashboard to hold the power and antenna cables out of the way of the HT's front panel.

The HT can easily lift off the mount and use it anywhere in the vehicle. A number of holsters and mounts are available on the market for holding an HT on a vehicle dashboard. These are much more expensive than this simple handle, and none holds the HT any better. Also, they take up much more room on the dashboard when the HT is not present.

Charles E.Cohn KK4CS
Austell GA

Connecting Circuit

I have read with interest the 1987 issue on Packet. The circuit to connect an IC-2AT is interesting. However there is a much simpler way to do it.

I have been using an IC-02AT for more than a year with an MFJ-1270 and later with a PK-232. I obtained the information on how to connect my rig to the TNC from the local BBS VE7KIT. I don't know who originated this connecting circuity. *It's Not Me!* And I don't take credit for it!! But it works really well! One may have to experiment with the value of the resistance the recommended 33kΩ worked fine with my system. I don't have any RFI problems and my TX Delay works fine at zero. I built the whole "circuit" in the DIN plug itself (isolating the leads to avoid shorts) as there is only a cap and a resistor.

I have seen this circuit on our BBS for months and I thought it was available on all BBS. As far as I know it works for the IC 2-AT as well as the 02-AT.

Patrick M. DuBois
Richmond, B.C. CANADA

Ten Meter Ground Plane Antenna

Now that the sunspots are returning and lower grades are admitted to ten meters, many people are shopping for suitable antennas. My choice was to build a ground plane, using a matching system which was widely used (commercially) on two meters about twenty years ago, which some people call a Beta match.

Actually, it is a shorted stub in parallel with the feed point, using one of the radials as part of the stub. It is very tolerant and broad-banded, which is important on such a wide band as ten. I made mine for 29 MHz, because I am interested in FM, but it works adequately over the whole band. Longer dimension would lower the frequency to your choice.

Radiator and radials are 8' 2" long and the stub is a 19" piece of RG8U, with cover and braid removed, wrapped in a loose spiral around the radial to keep it from sagging. Make all of the elements adjustable so it can optimize for frequency and SWR. This is a grounded antenna, for DC and perhaps also for lightning!

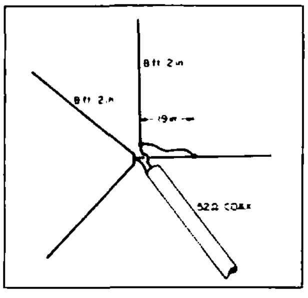


Fig. 4. 10m ground plane antenna.

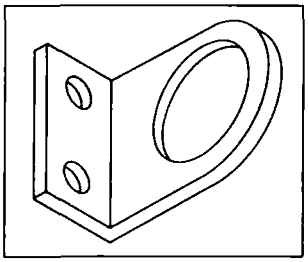


Fig. 5. Bracket for coax socket.

Improved J Pole Match

I have liked J poles for years and built many of them, but never found a simple way to get a completely flat SWR. Now I have. It looks a little unconventional in theory but it measures well. I made this one with square aluminum tubing, which is easier to work with mechanically, although not always easily available. If available, the mounting hardware is simpler as the diagram shows. The main difference between this model and others is the length of the radiating portion, which is increased from 38" to 47½" and allows a completely flat match at the design frequency. SWR readings are shown in Figure 2. Apparently, what we have here is a ⅝ wave element and a quarter wave matching section, at DC ground potential at the bottom, in the usual fashion. Remember that on these frequencies, lead dress of coax affects SWR as does proximity to other objects. Adjust installation with a meter for best results.

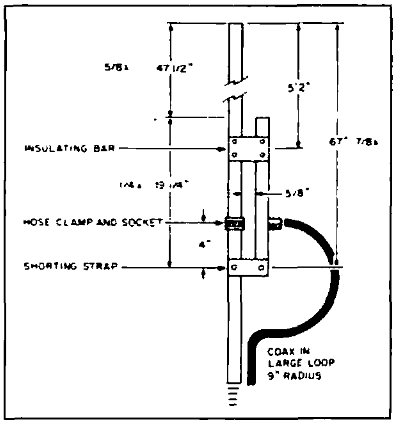


Fig. 6. Construction details of the improved J-Pole match.

Materials:

two pieces ¾" square aluminum tubing, one 19¾" for stub, one at least 7' long, for the radiator and main support, drilled for 8-32 bolts as indicated.

aluminum strap, ¾" x 2¼" drilled one 7.16" ctr.

insulating bar, 2" x 2¼" drilled one 7.16" ctr.

stainless steel hose clamp

small bracket to support coax socket (see drawing)

short piece of #14 wire between socket and stainless steel strap.

eight 8-32 bolts, nuts, and lock washers

Wm. Bruce Cameron
Temple Terrace FL

Number 38 on your Feedback card

INDEX: June 1988

Issue #333

BARTER 'N' BUY

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Dx

Hams Around the World

John TG9VT operates a "no-beacon" mailbox on 14085.625 kHz mark frequency at 74 baud. Access GUATMAIL in the daytime. At night, he's on AMTOR on 14073.500 kHz, with selcal TGVT. He runs an ICOM 751 to an Alpha 78 no-tune amp, feeding a 4-element quad.

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

RTTY DXing

The recent RTTY equipment revolution has dramatically improved the sport of RTTY DXing. Once the neglected stepchild of DX, RTTY DXing is rapidly entering the main stream of the pursuit of new countries.

With the replacement of the noisy, troublesome Model 19 by silent, smoothly-operating electronics, many more amateurs have joined the digital DX crowd, including many stations in other countries.

An important benefit of the shift to electronics has been the addition of RTTY gear to major DXpeditions. Clipperton FO0, Peter I 3Y1, and Howland Island KH1 are just a few of the many DXpeditions that packed RTTY gear as well as SSB and CW equipment.

The portability of modern RTTY gear has also led to a new phenomenon: the RTTY mini-DXpedition. Many countries, especially in the Caribbean, had seen little or no RTTY activity until a few short years ago. Now vacationers heading for some sun can pack some RTTY gear along with their portable transceivers, and generate some fierce digital pile-ups from their seaside QTH.

The increasing popularity of RTTY contests, especially the new CQWW RTTY test at the end of September, has prompted contest DXpeditions, such as the HD8DX digital trip to the Galapagos Islands in 1987. These DXpeditions greatly increase the number of countries available on the digital modes.

Getting Started

RTTY DXing shares many aspects with CW and SSB DXing. A DXer needs a station of at least average capabilities, better if possible, including a good rig and antenna farm. It is more difficult to copy ("print") weak stations on RTTY than on SSB or CW, so a good station proves more important in digital DXing than in other modes. Ideally, the rig should be very stable, as even a slight frequency change can garble transmissions. The ability to use a narrow CW filter while in the lower sideband mode is another DXing advantage. The rig should also be capable of continuous transmissions for extended periods. RTTY demands a great deal of stamina from a rig and its power supply.

RTTY DXers will probably want an amplifier, for the reasons given above. Again, continuous duty is a requirement, so amps with marginal power supplies may not be up to the task. The Drake L4B, Henry 2K, and Alpha amps are good choices.

There's a wide choice of computer and dedicated RTTY gear. I use a simple Commodore C-64, and AEA Pakratt PK-64 with HF modem, for example. In any case, read the instructions carefully, and master the CQ keys, callsign insertion, receive and transmit buffers, and all the other features of the equipment before trying to chase rare DX.

The single most important piece of equipment in RTTY DXing is exactly the same as that in other DXing: your ear. DXing is at least 90% listening (or watching). Almost all HF RTTY contacts occur in very limited band segments, with 14075–14100 kHz being the most popular. With increasing sunspots, check out the corresponding band segments on 10 and 15 meters, as well as the low band spot DX frequencies of 3590 and 7040 kHz. RTTY is permitted on the new WARC bands: tune around 10145, 18105, and 24925 kHz.

Beginning RTTY DXers will make the most headway toward digital DXCC by scanning 14075–14100 kHz on a regular basis. In addition to listening for DX signals, the DXer should also print QSOs from some of the better known, more active DXers on the band. JA1ACB, TG9VT, VK2SG, W3KV, and KT1N are good stations to copy, as they are usually informed about current RTTY DX activities.

The print publications contain useful RTTY DX information as well. The *RTTY Journal* includes a DX column by KT1N with lots of DX activity reports. And the weekly DX newsletters often have RTTY reports.

Don't neglect the rest of the band while concentrating on the RTTY segment. By listening to signals on the rest of 20 meters, for example, a DXer can get an idea of the propagation paths and band openings. Many rare RTTY DX stations dislike pile-ups, and tend to answer CQs. So when the band is open to that particular part of the world, a directional CO might put a new country in the RTTY log.

As with any DXing, keep the calls short and to the point. Avoid sending strings of RYs or repeating the DX station's callsign. Try "1 x 5" calls—the DX station's call once, followed by yours five times. And listen, listen.

RTTY DXing offers one feature not found on the other modes: It is entirely possible to have a valid contact with a station when no operator is present! Some DX stations maintain automatic "mailbox" stations and message centers. These stations will log a call and respond to it without need of an operator. A DX RTTYer can confirm TG9VT when John is not in the shack. Many of these RTTY bulletin boards can provide DX information, as well as lists of other such automatic stations. VK2AGE on 14073 kHz AMTOR has a weekly DX bulletin compiled by VK2SG, for example.

The RTTY DXer will also want to make good use of RTTY contests, especially the British Amateur Radio Teleprinting Group (BARTG) spring test, and the CQWW RTTY fall activity. The relaxed pace of the RTTY contests is a refreshing change from the feeding frenzy of SSB tests, but there's still plenty of excitement available for the digital DXer. Be sure to check out the rules and the scoring systems. (I'm still trying to figure out my BARTG score.)

The rapid increase in sunspots and the increasing availability of RTTY gear and stations means digital DXing will be great in the next few years. Why not give it a try? See you on the bands.

LA5HE's Commandments for QSL Managers

1. By accepting to act as a DX-station QSL manager, the volunteer assumes the responsibility to ensure that everybody who wants a card gets it in one way or another.
2. All cards received must be checked against the log copies received from the DX station, and a QSL card should be made out immediately and returned via the QSL bureau.
3. One of the services of a national society is to provide a QSL bureau for its members. The volunteer should maintain the membership of his national society (IARU member) to ensure proper receipt of QSLs via the bureau.
4. The volunteer should always make sure that the society's bureau is aware of the fact that he is handling QSLs for a station in a difficult part of the world, to ensure smooth cooperation from all parties concerned in his own country.
5. If the national QSL bureau is not automatically accepting QSLs for, or on behalf of, overseas DX stations, the volunteer should take the necessary actions to obtain acceptance before undertaking the responsibility to act as someone's QSL manager. This is very important, as the bulk of the world's QSL cards are sent via the bureau.
6. For prompter handling of QSL cards, many avid DXers are prepared to pay postage plus the service of a direct QSL card by air or surface mail. If the volunteer is prepared to provide this service, he should make sure that this information is provided by the DX station, as well as being published in the various DX news bulletins and Ham magazines. A good idea is to advise how many IRCs (International Reply Coupons) are required for air mail within the volunteer's own continent and the rest of the world, as one IRC covers surface postage only. He should make it known also if SASEs (Self Addressed Stamped Envelopes) are required.
7. For direct replies, the volunteer should never demand more than needed for actual costs. QSLs managers are expected to do their work out of dedication and pleasure. He should be prepared to accept a small loss, which will be compensated to some extent by those people sending excessive postage. Being a QSL manager, however, is most certainly a non-profit operation.
8. Remember: Being someone's QSL manager is a responsibility—not an ego trip!

QTH-DX

Number 31 on your Feedback card

QTH is AUSTRALIA

Leon Fletcher N6HYK

Amazing Australia

Many nights, there are so many clear signals coming in from VK-land (Australia) that some California hams would say, "VK hardly counts as DX."

Many East Coast hams also find Australia fairly easy to work. Even hams in Europe, who are located the farthest from Australia on this planet, do not include VK in their list of "100 most wanted countries."

But Australia, the world's largest island, is certainly one of the world's most fascinating countries. For starters, it ranks in the top ten nations in a startling 51 features. Some Australians are considered to live with the best physical quality of life and have the most graduates and pupil-to-teacher ratio. Australia has the most new houses built, passenger cars, radio receivers, hospital beds, and airfields per capita. It is also proud of the civil aviation flying distances, advertising expenditures, registered industrial designs, and magazines. And the Australians consume more meat, sugar and rubber per capita than any other country.

Intriguing Contrasts

Within these rankings, reported in *New Book of World Rankings* by George Kurian, there are some intriguing contrasts. For example, Australia has the world's highest literacy rate for both males and females, yet it also tops the world in rates of rape and other sex offenses. Despite Australia's high ranking as seventh on an index called "New Social Progress," it ranks second in the world for juvenile crime.

Even though Australia is considered to be among the top ten nations of the world in having the best physical quality of life, many of its citizens apparently feel a need to escape from that desirable existence by being one of the leading countries for drug-related crimes.

Population Stats

Many Americans know Australia is about the same size as the continental United States. But some people are surprised to learn that Australia's population is less than 16 million, nearly a million fewer people than in Texas!

There are 17,207 hams in Australia, smaller than the ham population of Pennsylvania. Australia has one ham per 916 residents, compared with one ham for every 529 residents in the United States.

Amazingly, one of every four residents in the nation live in Sydney. Sydney is the country's most populated city, with about 3.3 million people. Australia's capital, Canberra, has about 250,000 residents, roughly the same as Rochester, New York, or Fresno, California.

The unusual facts about Australia, some of which were reported in the February 1988 edition *National Geographic,* seem unending. It is the only nation that is a continent. Its largest lake, Eyre, is 3,600 square miles, about 1.5 times as large as Delaware—yet it is bone-dry almost all of the time. Australia has ten times as many sheep as people. It is one of the least densely populated countries in the world with only an average of only five people per square mile. Voting is compulsory. Nearly all of the world's opals come from Australia. And its per-capita income is one of the highest in the world at $11,200 equivalent in US dollars.

Man-made and Natural Wonders

Not statistics, but sights are Australia's major attractions. They range from impressive man-made drama to spectacular wonders of nature.

Pictures of Sydney's unique Opera House show the tops of its curved walls flowing inward to become roofs, uninterrupted by the 90-degree angles. Those walls soar up to 230 feet high, about the height of a 21-story building. The structure is covered with 1,056,000 white tiles made in Sweden. To some people, the building looks like billowing sails of a beautiful ship, to others it looks like a pile of broken eggs.

But the Opera House is much more than its name suggests. Indeed, opera is not even its major production. The structure includes five main performing halls, with the Opera Theater being the second largest in the building. Even though the Opera Theater seats 1,547 people and has a curtain longer than half a football field, the larger is the Concert Hall. The Concert Hall seats 2,690 people. It is used for symphony performances, chamber music, jazz and pop concerts, conventions, and such. The Australians claim the largest mechanical action organ in the world is housed here–10,500 pipes, built at a cost of $1.2 million.

Also located in the Opera House are a Drama Theatre, a Playhouse, and a Recording Hall. Then there are five rehearsal studios, an exhibition hall, two restaurants, six bars, and a library; a total of 900 rooms!

The natural wonders of Australia are indeed diverse. Wildlife includes about 400 native animals, plus about 600 species of birds unique to the country. There are more than 170 marsupials–kangaroos, koalas, wombats and such. The 50 types of kangaroos range from just a few inches tall to over six feet; some of the big "roos" jump 20 feet and race along at 30 miles an hour.

Another impressive wonder of nature in Australia is the world's biggest collection of coral in the world, the Great Barrier Reef. It extends for 1,250 miles along the country's northeast coast, lies about six to 62 miles offshore and ranges from 10 to 150 miles wide.

The reef, along with Australia's many other superior beaches, draw many locals to become almost year-round swimmers, beach loafers, snorkelers, skin divers, shell hunters, and sun-worshipers supreme. But such pleasures give Australians the unenviable record of suffering from the world's highest rate of skin cancer.

Another spectacular wonder of nature is Ayers Rock, the largest rock in the world. It is located in the middle of the continent with the nearest town of Alice Springs only 280 miles away. Ayers Rock is 1,143 feet high, 5.5 miles around, set virtually alone in a broad, sandy plain. The rock is open for tourists to climb. The Aborigines call it "Uluru" and consider it a very sacred site since many of their legends center on it.

Australian Aborigines have wandered the continent for at least 40,000 years. Anthropologists estimate that about the time European ships reached Australia, the Aborigine population was more than 300,000. Today there are only about 50,000, plus 150,000 part-Aborigines.

Happy Birthday!

This year, Australia is celebrating it 200th birthday. On January 26, 1788, after an eight-month passage from London, a fleet of eleven ships arrived in what is now Sydney Harbour. The vessels had set sail from London with 776 convicts. Britain had decided to reduce crime by shipping convicts to Australia. That continued for 80 years and by the time such banishment was outlawed, 162,000 criminals had been sent to Australia.

Many outsiders find the strangest feature in all of Australia is the language they speak. It is English but not the brand known to Americans. It's *fair dinkum* (absolutely true) that if you're really *up a gum tree* (in a quandary) for a QSL card from Australia, *give it a burl* (try it) by calling "CQ VK-land"–chances are you'll soon be hearing a *copper* (friend) from Down Under answering, "Goo'dye mite!"

Number 33 on your Feedback card

73 INTERNATIONAL

edited by Richard Phenix

Notes From FN42

Not a week passes here at Wayne Green Enterprises without at least one exotically-stamped envelope arriving, bearing within a request for a free subscription to 73 Amateur Radio. *Many of the requests are made by individuals who have thought to themselves, gosh, they print tens of thousands and probably have hundreds left over. It would cost them only the postage . . . .*

It doesn't work that way, of course. Magazine prices are set to cover all the costs of production and distribution not covered by advertising income. One item of expense: courtesy subscriptions for a limited number of individuals (or organizations) who have earned them in one way or another or whose subscriptions may lead to greater circulation. The magazine industry is, after all, supposed to be profit-making.

In the amateur radio field there is a nonprofit element, however. It can never be preached too often that amateurs have public service responsibilities, and are licensed with the understanding that they will meet their obligations. 73 Amateur Radio, *therefore, does give a number of free subscriptions on behalf of those obligations. It is our hope that amateurs and amateur organizations, particularly in international terms, will also assist hams who, for instance, live in areas or under circumstances where outside help clearly could make the difference between healthy and growing ham activity and perhaps no activity at all.*

Underwriting the cost of a subscription to the amateur radio magazine of your choice is one example of assistance that can be given, and from time to time you will see in these pages, an opportunity to do this. See the Nepal item below. In the case of Nepal, we are sending 9N1MC a one-year subscription.

Dates to remember in June: 1—Children's Day, China, National Day in Tunisia; 2—Anniversary of the Republic, Italy, Coronation Day, Great Britain; 3—Labor Day, Bahamas; 4—Queen's Birthday, New Zealand (on the 11th for Australia and Great Britain); 5—Liberation Day, Seychelles (which celebrates Independence on the 29th); 6—Memorial Day, South Korea, Bank Holiday, Ireland, National Holiday, Sweden (and for Portugal on the 10th, Luxembourg on the 23rd); 7—Independence Day, Norway (12th for the Philippines, 26th for Madagascar and Somalia); 14—Flag Day, USA (20th in Argentina); 17—Commemoration Day, Germany, Republic Day, Iceland; 18—Evacuation Day, Egypt; 19—Revolution Day, Algeria, Father's Day, USA; 22—National Sovereignty Day, Haiti; 24—Peasants Day, Peru, King's Day, Spain; 28—Mothers Day, Central African Republic.

> **Australia. LATE WORD.** EXPO88 plans (see April issue) drastically changed—no ham activity at the site, for example. Double check all information before counting on it.

Roundup

Correction. In the box on page 94, February issue, the two addresses in Portugal should be **REP-Rede dos Emissores Portugueses, Rua D.Pedri V, 4-4 Lisboa, 1000 Portugal** (and the reciprocal license fee is around US$30); and **Direccao dos Servicos Radioelectricos, praca Francisco Sa Carneiro 13, 1, Lisboa, 1000 Portugal.**

China. The China Radio Sport Association (CRSA) of the People's Republic of China (Zhonghua Renmin Gonghe Guo) set up stations BTØLS and BTØZML last March for SSB and CW communications for a very special March-to-May, tri-nation mountaineering party (see QSL cards). The mountain: "the highest in the world—Qomolangma," writes Chang Han Dong. [*Mt. Everest—or Mt. Zhumulangmafeng—Ed.*] Half the mountaineers were to climb the north face, half the south, to meet at the peak and keep going, making the first-ever dual, over-the-peak conquering of Everest's 29,028 feet. ZML was the base camp station, LS was in LaSha (Lhasa), capital of Tibet. May 5th was to be the meeting day at the peak, at which time the Japanese Broadcasting Net planned a telecast via satellite to the whole world. The frequencies allocated for the occasion were 14.180, 14.330, 21.330, 21.180, and 7.080 MHz.

Czechoslovakia. Our Czech correspondent, Rudolf Karaba OK3CMZ, has indicated that no additional information is called for by his country beyond that requested in our draft Universal Permit Application form (for operating permission) as published on p. 78 of our January issue. He proved it by filling one out for himself and sending it to us, with the attachments called for. (We now know he drives a Fiat when mobiling, has grey eyes, and his call suffix, phonetically, is Cyril, Maria, Zuzanal) Thanks!

Israel. Want to learn the international (UN approved) language, Esperanto? Reportedly it can be learned in one-fifth to one-twentieth the time needed for a typical national language. Or, as the Esperantists say, Inteligenta persono lernas la lingvon Esperanto rapide kaj facile. Tune in Naftali 4Z4RM's weekly magazine-on-the-air linked between 40 meters and VHF repeaters in the north and south of Israel, where Rami Shlain 4Z4LX will give you a ten-minute lesson. (See the October 1987 international column for his picture.) It also is taught at the Tel-Aviv Youth Center, the home of the 4X4HQ radio club. There is a 350-plus-member International League of Amateur Radio Esperantists (ILERA) which puts out a quarterly magazine, each issue edited in a different country, and has an annual international contest in Esperanto on the HF bands on the third weekend in November. Last year 162 stations in 22 countries participated. Rami represented Israel at last year's 72nd conference of the Universala Esperanto Asocio (UEA) in Poland where 80 countries were represented, of which 18 had representatives on the Esperanto ham organization.

Republic of Korea (South Korea). Our special Olympic correspondent, HL5AP (see the International column for November, 1987, page 96), wrote a few months ago that he was QRL, following duty with some 30 others as radio men for the Olympic Practice Yacht Regatta in the Bay of Suyong, off Pusan. He will be providing the same kind of volunteer service for the Seoul Olympic Yacht Regatta. Frequencies have been allocated for the Olympics (see box), and we hope to have more details from Byong-joo Cho soon. If you plan to go to Seoul (the Sports Complex and Olympic

Photo A. Byong-joo Cho HL5AP.

OLYMPICS FREQUENCIES

HF, 50 W, CW, SSB, RTTY: 3500–3550, 3790–3800, 7000–7100, 14,000–14,350 kHz; FM also: 28,000–29,700 kHz.

VHF, 25 W, CW, SSB, RTTY, FM: 50–54, 145-146 MHz; same for UHF, 435.075–440.000 MHz.

Park are 10 miles from the city, just over the Han River) you'd better make arrangements yesterday. A recent report said that there are about 32,000 tourist rooms in Seoul, and 240,000 visitors are expected.

Nepal. Krishna B. Khatry 9N1MC, Chief Engineer for the Nepalese Ministry of Communications, writes that he is "trying [his] best to promote amateur radio in this country." [*To help, we are sending him a courtesy subscription of 73. The Kingdom of Nepal (Sri Nepala Sarkar), about the size of North Carolina, has a population of about 17.5 million; Kathmandu, 125,000, is the capital. Virtually closed to the outside world for centuries, it now is linked to India and Pakistan by road and air, and to Tibet by road.—Ed.*] He wrote of the DXpedition license granted to the Japan UNICEF Ham Club of Hokkaido for a ten-day period last December, as part of the celebration of the 43rd birthday of His Majesty, King Birendra Bir Bikram Shah Dev, of Nepal. Station 9N7YDY was operated from Kathmandu. Seven operators were authorized: JA7 BOB and XBG, JA8 OW and RUZ, JH1LKH, JH7WKU, and JN1XWO.

Sweden. The proposed Universal Permit Application looks good to Rune Wande SM0COP and Erik SM0AGD, and they suggest two additions: a place on the form where the applicant can suggest the call he would like to have assigned to him. This can be helpful to some countries where uncertainty is felt about the call to assign. "We have experienced very strange calls in some cases." And: "If there is a host or a contact person in the country one wants to work ham radio from, it [could break] red tape in many cases." [*See Zimbabwe, below, where 8000 km (5000 miles) away, give or take a few hundred, the same bright idea struck...*]

Photo B. Nepal's 9N1MC, center, with (L to R) Yasuo Makiyama JA7BOB, Tetsuya Sakabe JA7XBG, Lloyd Colvin W6KG (who operated 9N5QL with W6QL, separately), Masakazu Sezaki JN1XWO, and Toshikazu Kawanishi JA8RUZ.

Zimbabwe. Bernard C. Herring Z21EI also endorses our Universal Permit Application as proposed. He makes the excellent suggestion [*and see Sweden, above!*] that in some countries the whole matter could be smoother for everybody if the application were made for the use of the gear of a resident amateur and, again in some countries, for that use to be under the supervision of the local ham. This could be made easier yet if a local amateur radio organization endorsed the idea and became the contact point for the prospective visitor looking for a local sponsor. [*A list of such countries can be added to the Universal Permit Application kit if enough national groups agree to sponsor visitor assistance plans. Let us know!*]

CANADA

Garry V. Hammond VE3XN
5 McLaren Avenue
Listowel, Ontario
Canada N4W 3K1

[*VE3XN is National Awards Manager for the Canadian Radio Relay League, CARF, and the Maple Leaf Radio Society. He has been chasing one aspect of amateur radio after another for 30 years, starting with SWLing and now awards. Over the years he has used over 16 Canadian prefixes, with the most recent being VX3SN (in conjunction with the Calgary Winter Olympics) and VE8XN, for use at the base camp of the Polar Bridge Ski Expedition of UA–VE (see January issue, p. 72). He is QSL manager for himself, HS1AMM, VP2MF, and ZF1MA. His present two-letter call was used by a Canadian pioneer operator, Hobbs Langford. The XN-4 was an early Canadian radio receiver. Nine of his Canadian prefixes were with XN. He publishes* The Amateur Radio Awards Directory of the World, *(a revised edition each year). What would you bet that the kids in the Listowel secondary school district get especially interesting geography lessons? Garry has headed the Geography Department there since 1962.—Ed.*]

The CRRL 1988 Polar Bridge Diploma

In honor of the Transpolar Ski Expedition, Severnaya Zemlya, USSR, to Ellesmere Island, NWT, Canada. A bilingual certificate for nine QSOs or loggings between February 15 and June 15, 1988:

- 3 different calls from North West Territories—usually VE8, but the CI8 prefix is optional here
- 3 different calls from Asiatic RSFSR (Russian Soviet Federated Socialist Republic)—usually UA9 or UA0
- 1 Base Camp Station from either Canada or the USSR (CI8C will be heard from the Resolute Bay, NWT Camp)
- 1 station from national capital region of Ottawa
- 1 station from national capital region of Moscow

Send application, certified log data (no QSLs), and 10 IRCs or $5 to me at the above address.

FRANCE

Claude Guee FD1DGY
11 Rue Emile Labiche
28100 Dreux
France

[*FD1GY was last heard from two years ago; and that column came two years after the one before "due to a car crash and other QRM," as he put it. Hope all QRM clears up and it won't be 1990 before we hear again—how about more information about the "Gateway" project, and is there any chance that France's process for granting operating licenses to foreign visitors will be simplified?—Ed.*]

Some news from France

- The first "radio-amateur" association in France now has for the first time a YL at its head, Therese Normand FE6EPZ. Let's wish courage and good luck to this valiant YL in any future hard struggles...a new difficulty has arisen which may slow future growth, and already France probably has a smaller rate of amateurs—the cost of a license has gone up, and also the examination charges (practically double from last year, for a beginner).
- 50 MHz could be allowed in France, but with strong restrictions in area and power, due to the use of TV.

• Sandrine FA1MSG is the youngest radio amateur in France (13 the day of her exam)! Her A license doesn't allow many international QSOs, but this is only a beginning!

• This year, our national license is extended to Austria, Liechtenstein, Monaco, Netherlands, Norway, Switzerland, and West Germany, with Belgium possibly next. (With reciprocity, of course.) This may be the beginning of a Europe-wide license, an important step, and maybe even more, why not?

• Packet radio is growing rapidly here. The "hexagone" is now covered by more than 80 repeaters (144,675). Only in the west (the IN square) is there relative inactivity. There are now over 1,000 packetteurs and more than 80 BBS's, on the same frequency. F6ABJ's Paris BBS is also on 145,275 because of heavy activity. The live-wire group ATEPRA (FE6WV, F6ABJ, etc.) has been promoting this new activity.

During the last congress, in Provins, the following standardization was recommended for the SS IDs:
Ø—operator... 1—BBS... 3—QRV 24/h/24 with operator... 4,5,6—repeater, without operator... 7—portable... 8—portable without operator... 9—mobile, portable... 10-13—reserve... 14—emergency... 15—reserve.

"Gateway" is a very ambitious project by F6ABJ, with an HF station near Paris (7-element beam, 14 MHz, 30 meters ASL) connected with a UHF link to the capital, to make easier intercontinental packet QSOs.

• Chuck AB4Y has left France after a too-short stay here. He was the founder of PIARA, the international amateur radio club in Paris which is so helpful to travelers to Paris. Monthly meetings are held in the famous restaurant, Jenny. Many thanks, Chuck, and a *tres bientot!*

HONG KONG

Phil Weaver VS6CT
10A Bonaventure House
91 Leighton Road
Hong Kong

[*This is Part 2 of a two-part report; Part 1 was in the April issue—Ed.*]

Our Class B licenses continue to expand, and at the end of 1987 we had 373. With 190 Class A, this meant a total of 563, and expansion will continue as exams are now going to be given in Chinese. Until now they have been the same as those given in the U.K. by the City & Guilds of London, in English only.

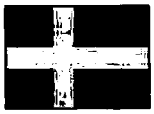
As 10 meters becomes more active, I am afraid you will be hearing a lot of AM interference from illegal stations in Asia. Hong Kong is not alone in having this problem, where the taxi drivers have discovered a brand new world of communications amongst themselves to the detriment of other amateurs. The two main frequencies they use are 28.405 and 28.515 kHz. The local telecommunications authorities are well aware of the problem and, in conjunction with the police, catch the occasional transgressor, but the problem is endemic, and unless we can get complaints from around the world, there is little more that will be done. The problem exists in Malaysia and Indonesia also, and when the band is open to that part of the world, you will well and truly know about it!

Because of my new job [*in charge of the Port of Hong Kong Communications Center—see Part 1.—Ed.*] I have had to resign from the Committee of HARTS, after seven years, but it was good to leave after an Annual Dinner with 166 people present made it the best ever; and there were over US$7,000 worth of door prizes, thanks to local Kenwood, Waysun, Goodyear, and Pacifica Products dealers!

HARTS had five transceivers stolen from one of its 2-meter sites, and it will be some time before we can collect the money to get back to normal activity. Private repeaters have been authorized recently, and three licenses have been issued. I am sponsoring one, using English, which will be helpful for those unable to understand Cantonese.

Last August, typhoon Rima swept through the Far East, leaving a trail of smoked radios, toasted antennas, fried amplifiers, and disillusioned amateurs in Bangkok, Macau, and the Philippines. Luckily, Hong Kong was spared.

Finally, I regret to announce that our Telecommunications Authority friend, Mr. T.C. Chan VS6DW, MBE, has retired. He has done so much for amateur radio, from the official side, that his shoes may never be filled: his post will not be filled at this time because there is nobody knowledgeable enough. There will be two people splitting up his work load. We understand he is retiring to Canada; and all of us wish him a happy retirement.



SWEDEN

Rune Wande SMØCOP
Frejavagan 10
S-155 00 Nykvarn
Sweden

Common License Approved

The European Common License has been approved in Sweden as of March 1—in part. It is in accordance with the so-called CEPT Recommendation and is valid for amateurs from those other countries which also have implemented this kind of license. It means that amateurs from West Germany, Norway, Denmark, The Netherlands, Luxembourg, Belgium, Austria, Switzerland, France, and Monaco do not need to apply for a visitor's license when in Sweden—IF they are satisfied working only VHF according to CEPT Recommendation Class 2. Unfortunately, the Swedish authorities did not accept the full CEPT plan. The Swedish Telecommunication Authority did accept the full plan, but was overruled by some other government entity. Let us hope that the obstacles, whatever they were, will be cleared away in the near future.

Did you work 7S8AAA? The Swedish Antarctic Research Program (SWEDARP) was assigned the call 7S8AAA, and early this year a group of 12 geology researchers spent a few months in the Antarctic. Kent SM7DSE, a University of Lund professor, was the one who made amateur radio a part of the expedition. He planned to work CW, SSB, RTTY, AMTOR, and HF Packet. They also had a license for 3Y Bouvet, but as of this writing it is uncertain whether they'll get there this time.

QSL cards can be sent via SKØ MT, Club Taby Sandaramatorer. If you didn't work 7S8AAA this time, you will probably get another and bigger chance next year. I'll keep you posted.

Market Reef SI8MI I

SKØMT has become a very active club. They managed to get a special call for the Swedish part of the Baltic Sea rock known to DXers as Market Reef (prefix OJØ). For years the Finnish lighthouse on this tiny rock was on the Swedish side, and the national border was drawn through the rock! In 1985 the border was redrawn to put the lighthouse back in Finland (see map). On September 26 of that year SI8MI went on the air for the first time, but for only a few hours because of bad weather, and there are no shelters on the Swedish side. There is a good possibility that the call will be heard again this summer, however. Although it does not have DXCC status, it is a rare call! QSL via club SKØ.

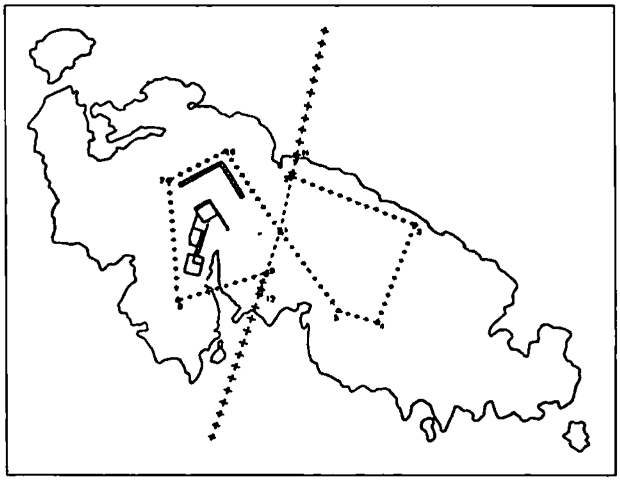


Figure 1. The old border went vertically through the middle of Market reef, which in all is about 400 meters in length and averages about 150 meters wide. The new border cuts left and around the lighthouse, and then cuts back into Finland to give Sweden an area of rock equal to the area that went with the lighthouse.

Number 34 on your Feedback card

SPECIAL EVENTS

Ham Doings Across the Country

Special Events listings will be provided by 73 magazine free of charge on a space-available basis. Announcements must be received by the first of the month, two months prior to the month in which the event takes place (by April 1, for example, for a June or later event). Please mail to Editorial Offices, 73 Magazine, WGE Center, Peterborough NH 03458. ATTN: Special Events

LONG BRANCH NJ
JUNE 1-5

The Second Annual Convention of Chaverim International, an association of Jewish Amateur Radio operators, will be held this year at the Harbor Island Spa at Long Branch. Cost is $286 per person double occupancy, $436 per person single occupancy. Talk-in on 1 June 147.05 Asbury Park repeater. Deposit of $25 required. For reservations and information, contact *Foster Kawaler NV2W, 46 Megill Circle, Eatontown NJ 07724, or Bernie Schreibman, 362 Meadowbrook Ave., Eatontown NJ 07724.*

ST. PAUL MN
JUNE 3-4

The North Area Repeater Association will sponsor a swapfest and exposition at the state fairgrounds in St. Paul. Exhibits, flea market, dealers, prizes, license exams. $4 in advance, $5 at door. Write *Amateur Fair, PO Box 857, Hopkins MN 55343, or call 612-566-4000.*

BROOKFIELD IL
JUNE 4

The Chicago Suburban Radio Association will operate N9BAT from the Brookfield Zoo as part of the West Suburban Council Boy Scouts of America Scout-O-Rama. Operation will be on SSB frequencies 7.240 MHz, 14.260 MHz, and 28.350 MHz, and 2 meter FM 146.55 MHz. For full color QSL card, send your QSL card and large SASE to *CSRA N9BAT, Special Event, PO Box 88, Lyons IL 60534.*

PITTSBURG KS
JUNE 4

VEC exams, indoor flea market, free tables and parking, hamfest at Lincoln Park Pavilion sponsored by the Pittsburg Repeater Organization. Admission $5 per adult, $1 per additional family member over fifteen. Talk-in on 146.34/.94 or 147.84/.24. Contact *Ken Johnston KCØVZ, PO Box 1303, Pittsburg KS 66762.*

KITCHENER, ONTARIO
JUNE 4

The 14th Annual Central Ontario Amateur Radio Fleamarket, sponsored by the Guelph ARC and the Kitchener-Waterloo ARC, will be held at Bingeman Park. Admission $3, tables $5, children under twelve free. Talk-in KSR 146.37/.97, ZMG 144.61-145.21, Simplex 52/52. Contact *Fleamarket Co-Chairman, Ray Jennings VE3CZE, 61 Ottawa Crescent, Guelph, Ontario CANADA N1E 2A8. 519-822-8342.*

BANGOR ME
JUNE 4

The Pine State Amateur Radio Club is sponsoring their 2nd annual outdoor hamfest at the Hammond Street Campground. Admission $2, overnight camping June 3-5 available. PSARC annual meeting, election of officers, VEC exams, prizes, free swapfest space and more. Talk-in on 146.34/.94. Contact *Gerry Bell N1DQX, RFD 1 Box 1377, Bangor ME 04401. 207-942-3654.*

MADISON OH
JUNE 4-5

The Wireless Institute of Northern Ohio (WINO), sponsored by the Lake County AR Association, will be on the air to commemorate Ohio Wine Month. On June 4 from 2300Z to 0300Z, W.I.N.O will be operating from a local winery on 3860 and 7235 kHz, and on June 5 from 1500Z to 1900Z, they will be on 7235 and 14235 kHz. Call is KO8O. Legal-size SASE for QSL certificate from *KO8O - WINO Weekend, 10418 Briar Hill, Kirtland OH 44094.*

MANASSAS VA
JUNE 5

The Ole Virginia Hams will present the Annual Manassas Hamfest and Computer Show at the Prince William County Fairgrounds from 8 AM to 4 PM. Admission $5, children under twelve free. Tailgating $5/space. YL Program, ARRL booth, CW proficiency awards, dealers, indoor space. Talk-in on 146.37/.97, 146.52. Contact *Joe Schlatter K4FPT, 703-368-8599 (evening) or Randy Moler KA4UFF, 703-791-3061, or write Ole Virginia Hams ARC, PO Box 1255, Manassas VA 22110, or call Jack Gunsett KI4VP, 703-361-5255.*

HUMBOLDT TN
JUNE 5

The Humboldt ARC will sponsor its annual hamfest at Baily Park from 8 AM to 4 PM. Admission $1, refreshments, flea market, and parking for RVs. Talk-in on .37/.97. Contact *Ed Holmes W4IGW, 501 N. 18th Ave., Humboldt TN 38343. 901-784-3490.*

CHELSEA MI
JUNE 5

The 11th Annual Chelsea Swap 'N Shop, sponsored by the Chelsea Communications Club, will be held at the Chelsea Fair Grounds. Donation $2.50 in advance, $3 at door. YLs, XYLs, kids under twelve free. Table space $8, trunk sale space $2. Campgrounds and parking. Call *313-475-1795, Robert Schantz, 416 Wilkinson Street, Chelsea MI 48118.*

SORRENTO LA
JUNE 6-12

The Ascension ARC will hold its Annual Jambalaya Festival from 1500Z to 2359Z daily on 20-15 and 10 meter bands. Special Event package contains three Jambalaya Recipes, Certificate and Club Card with station, state and country worked, plus Honorary Membership Certificate for three or more stations worked. Send $1 postage and QSL card with calls to *A.A.R.C., PO Box 278, Sorrento LA 70778-0278.*

LOVELAND CO
JUNE 10-11

The Northern Colorado ARC is sponsoring the Tenth Annual SUPERFEST at the Larimer County Fairgrounds in the McMillan Building. Prizes, dealers, VEC examinations, refreshments, and a flea market. Station WØINK will be operating on HF with talk-in on 2 meter. Contact *Bud Hayes WØJFN, 3109 N. Douglas, Loveland CO 80537. 303-663-3119.*

MIDLAND MI
JUNE 11

The Central Michigan Amateur Repeater Association (CMARA) is sponsoring its Fourteenth Annual Hamfest at the Midland Community Center. Donation $3 at door, tables $4 and $8. FCC exams, new and used equipment. Contact *David C. Burdeaux WD8DII, CMARA Vice-President, CMARA Hamfest, PO Box 67, Midland MI 48640.*

WINSTON-SALEM NC
JUNE 11

The Forsyth Amateur Radio Club is sponsoring the Winston-Salem Hamfest & Computer Electronics Fair '88 at the Dixie Classic Fair Grounds. FCC exams (preregistration suggested), indoor dealer space, prizes, and flea market/tailgating space. Admission $4 in advance, $5 at door. Talk-in on 146.04/.64. For preregistration (SASE) contact *Dave Ward KA1LVO, 5573 Vienna-Dozier Rd., Pfafftown NC 27040.* For dealer information, contact *Jim Rodgers N1DRI, Box 11234, Winston-Salem NC 27116, 919-760-2493.* For exam information, contact *Bob Gates KJ4IC, Box 60, Cedar Grove Park, Kernersville NC 27284.*

RIO DE JANEIRO BRAZIL
JUNE 11-12

Hundreds of CW operators in South America will be on the bands this weekend. They welcome other hams who wish to meet them for the World Wide South America CW Contest. WWSA is sponsored by *Antenna-Eletronica Popular* with the cooperation of Pica-Pau Carioca and other South American CW groups. *Antenna, PO Box 1131, 20001 Rio de Janeiro, RJ, BRASIL.*

GALESBURG IL
JUNE 11-12

If you would be interested in participating in an International Telegraph Speed contest, and want more details on awards, contact *Jim Woods, The Blackhawk Chapter of the Morse Telgraph Club, RR #4 Box 22, Galesburg IL 61401.*

QUEENS NY
JUNE 12

The Hall of Science ARC Hamfest will be at the New York Hall of Science parking lot, Flushing Meadow Park, 47-01-111 Street in Queens from 9 AM to 3 PM. AR exhibit station, tune-up clinic, films. Donation $3. Sellers $5/space. Talk-in on 144.300 simplex link 223.600 repeat and 445.225 repeat. Contact (evenings) *Steve Greenbaum WB2KDG, 718-898-5599 or Arnie Schiffman WB2YXB, 718-343-0172.*

WINFIELD PA
JUNE 12

The Milton and Central Susquehanna ARCs will host the 15th Annual Central PA Ham and Computer Fest at the Winfield Fireman's Fairgrounds from 0800 to 1700 EST. VEC testing (advance registration), good food, contests, Demo BBS, packet radio, and more. Donations $4. YLs, XYLs, and children are free. Tailgating 6' table for $1. Talk-in on 146.97, 147.18, and 146.52. Call or write *Jerry Williamson WA3SXQ, 10 Old Farm Lane, Milton PA 17847, 717-742-3027 or Bob Stahl KA3PYT, 452 Fourth St., Northumberland PA 17857, 717-473-7050.*

COVINGTON KY
JUNE 12

The Northern Kentucky ARC will hold its HAM-O-RAMA 88 at the Erlanger Kentucky Lions Park. Admission $4 in advance, $5 at gate. Children under fourteen free. Prizes, ARRL, packet and emergency forums, vendors, and a outside flea market ($4/space, tables not provided. Talk-in on 147.855/.255 and 147.975/.375. For advance registration or more information, contact *WA4BRM, c/o NKARC, PO Box 281, Florence KY 41042, 606-371-8545.*

WILLOW SPRINGS IL
JUNE 12

The Six Meter Club of Chicago is sponsoring The Thirty-First Annual Hamfest at Santa Fe Park. Admission $3 in advance, $4 at gate. Prizes, large swapper's row, picnic grounds, displays in pavilion, and an AFMARS meeting. Talk-in K9ONA on 146.52 or K9ONA/R 37-97. Advance tickets and information from *Mike Corbett K9ENZ, 606 South Fenton Ave., Romeoville IL 60441.*

AKRON OH
JUNE 12

The 21st Annual Goodyear Family Hamfest will be at Wingfoot Lake Park near Akron. Family admission is $4 in advance, $5 at gate. Picnic and flea market ($3 per vehicle), and sheltered indoor dealer area ($6 per table, advance reservation suggested). Prizes for the OM, XYL, children, and Mobile Check-in. Park facilities and concessions. For tickets and information, contact *Don W. Rogers WA8SXJ, 161 Hawkins Ave., Akron OH 44313. 216-864-3665.*

SOUTH DARTMOUTH MA
JUNE 12

The Southeastern Massachusetts AR Association is holding its Semara Hamfest from 9 AM to 5 PM. General admission is free. Dealer admission is $8 in advance, $10 at door. VEC exams by appointment, Nepra packet workshop, working HF stations, and Tail Gate Sale. Hamfest talk-in on 147.000/.6 and 145.4900/.6 for backup. Contact (send SASE, please) *Peter M. Kodis N1EXA, PO Box 9187, North Dartmouth MA 02747. 617-993-1828.*

PHILADELPHIA PA
JUNE 15

A technical session featuring recent developments in Amateur Radio will be part of the IEEE International Conference on Communications '88 in Philadelphia. Jim Metzger KA3HWD, will take visiting Amateurs on a tour of the club station where they may use the repeaters (145.25 (KA3HWD/R), 224.52 (K2PM/R), and 443.10 (K3QFP/R) at the Liberty Bell site. For information, write *ICC '88, c/o ATT Network Systems, 1800 John F. Kennedy Blvd., Suite 1300, Philadelphia PA 19103 or call 1-800-ICC-88PH or 215-972-1308 (outside the US), weekdays 8 AM to 4:30 PM EST.*

NEW YORK NY
JUNE 16

The IEEE New York Section Broadcast Technology and Vehicular Technology Chapters are sponsoring "Professional Certifications Programs: An Overview." There will be representatives from the SBE, NABER, NARTE, and possibly the FCC. Admission is free. Time: 6:30 PM at the NYC Technical College, Klitgord Auditorium at 285 Jay St., Brooklyn. For more information, call *Mike Hayden at 212-246-2350, ext. 278, from 9–5 PM.*

HUGO CO
JUNE 17–19

The 13th annual SMIRK Party Contest will be held from 1900 CDT on the 17th to 1900 CDT on the 19th. Exchange callsign, SMIRK # and Grid Square. Crossband contacts, multi-operator or partial contacts not allowed. For scoring, rules, and information on awards, write *Lisa Lowell KAØNNO, PO Box 547, Hugo CO 80821.*

CORTLAND NY
JUNE 18

The Courtland Hamfest, sponsored by the Skyline ARC, will have indoor/outdoor flea markets, prizes, plenty of space and refreshments. Talk-in on 147.225 (+600) or 145.490 (-600). For reservations, contact *Skyline Amateur Radio Club, PO Box 5241, Cortland NY 13045 or call Jerry Falletta KD2DR 607-844-9350, Billy Williams N2AGF, 607-749-3766, or Bill Ackroyd WA2UFO 607-844-4815.*

DUNELLEN NJ
JUNE 18

The Raritan Valley Radio Club will hold its 17th annual Hamfest at Columbia Park. Donation $4, children and spouses free. Seller spots are $6/space or $12/multiple spaces. Prizes and refreshments. Talk-in on club repeater W2QW/R 146.025/.625 and 146.52 simplex. Advance tickets from club members or call *Dave KA2TSM at 201-763-4849, or John WA2C at 201-968-5070.*

PARK RIDGE NJ
JUNE 18

The 3rd annual SWL FEST will be at Gilfer Shortwave, 52 Park Ave., from 10 AM to 3 PM. Free admission. $3 per space for sellers (call early for reservations). Contact *Paul Lannuier N2HIE, PO Box 239, Park Ridge NJ 07656. 201-391-7887.*

MIDDLETOWN MD
JUNE 18

The Frederick ARC will hold its 11th Annual Hamfest at the Frederick County Fairgrounds from 8 AM to 4 PM. Admission $3, tailgaters $2 extra. First table $10/ea, extra tables $5/ea. YLs and children free. For more information, write *Dave Durkovic N3BKD, 7128 Limestone Lane, Middletown MD 21769.*

MONROE MI
JUNE 19

The 1988 Monroe County Radio Communications Association Hamfest will be at the Monroe County Fairgrounds. Tickets are $2 in advance or $3 at gate. Spouses, children free. Table space $6 and trunk sates $2 per space. Simplex talk-in on 146.52 MHz. Local repeaters are W3SOG/R on 146.73 MHz and WA3OHI/R on 147.06 MHz. To reserve space or order tickets, send request with SASE to *Larry Lindner KB8AIZ, 2001 Ida-Maybee Rd., Monroe MI 48161 or call Larry at 313-587-3663.*

ESCONDIDO CA
JUNE 19–25

The Escondido Amateur Radio Society will operate N6WB in conjunction with the 100th anniversary of the City of Escondido. For a large certificate, send QSL and large SASE to *Glenn Bodeker N6WB, 127 Walnut Hills Dr., San Marcos CA 92069.*

REDLANDS CA
JUNE 20–JULY 4

KX6B will operate mobile as part of the support team of Car #73 in the running of the 6th annual Great American Race to commemorate the 80th year since the original New York to Paris race. Operations will be daily 1500 UTC until 2300 UTC on the lower 25 kHz of the 40, 20, and 15 meter general phone band. Some evening operation on 75 meter phone band. Mobile Packet on 145.01 and 2 meter FM on area repeaters. For OSL send SASE to *Dick Raley KX6B, 2610 Camloop Drive, San Jose CA 95130.*

KELLEYS ISLAND OH
JUNE 29

Members of the Ohio Underwater Research Association will operate N8HHG from 1500Z to 0100Z underwater from Lake Erie aboard a shipwreck and other submerged as well as surface locations within the Lake Erie Islands area. Frequencies: 7.230, 14.245, 28.450, and 146.475 MHz (all ± 10 kHz). For photo QSL card, send QSL (SWL letter welcome) and SASE to *Paul Buescher N8HHG, 1752 Stone Creek Lane, Twinsburg OH 44087.*

LETTERS

From the Ham Sack

Rare Finds

We, the radio amateur, are our own worst enemy. Good quality public relations that the public can understand is rare. This is only part of the problem. I became an amateur in 1971 while at college. There was a sense of discovery—an air of mysticism, of being able to take junk parts from the local radio/TV shop and make them talk around the world. There was a sense of comradeship, of adventure. Over the years we have lost out: We have become appliance operators lacking the ability to build even the simplest equipment. Part of the problem comes from ham radio magazines. They seem to think that since technology has advanced, so have the building abilities of amateurs. Seldom do I find simple, goof-proof projects using 'Radio Shack' parts that are worth any time or effort to build. If *73* magazine could, in addition to or within its current departments include those simple, goof-proof projects for amateurs, it would be providing a service that no one else provides.

Larry G. Sloop WB4UYY
Millers Creek NC

Many of our readers have similar requests, but how many understand we can only publish what writers send to us? Quality projects are few and far between in every US electronics magazine. Get busy, guys!... de NA5E

Russian Views

When I decided to visit the USSR, I started to learn some rudiments of Russian. No, I don't know much, but a minimum, just to ask for my way, for prices, comment about the weather, etc. Our guide did not care about me when he saw that I would not make any trouble for him and that I would not get lost. So, when I wanted to find hams, all I had to do was to examine the antennas on the roofs, and ring at the flats where the coax ended. The Q-code with my micro-knowledge of Russian made the rest. I found lots of helpful friends there. Being quite Vodka-proof, our friendship became even more cordial and I found that at least my friends were not great party fans. They admitted that being a party member helps a lot to get the private ham ticket. They also explained that for hamming they would do even more. Maybe Mr. Gorbatcheff will change the need for such an involvement.

People in the USSR are not easy to access. Their raw behavior shows timidness to strangers. But once the ice is broken, they are friendly, hearty, and handsome. As a foreigner it's up to you to show your interest and good will. Money is no argument for sympathy, in opposition to my experiences in the US.

By the way, do you know why the typical Russian SSB station has its characteristic sheet-iron sound? There is a shortage for all technical components on the privately accessable market. There are no stations to buy, no crystal filters, and no high-tech ICs. So the average station is built from scratch with the available TV repair material, often bought by friends who are thousands of miles away. Several projects have been published in the *Radio* magazine. The best known "19 tube, home built transceiver" is of course always the same model. SSB is made with a balanced multiplier in the 100 kHz region, LC filtered, then mixed up twice. Output power is about 200 watts, using 3 TV line amplifier tubes. How will you expect such a technology to compare to our factory built high-tech transceivers? But at least they build their own stations.

Club stations usually sound better, as they get obsolete marine transceivers which are often older than the operator. Do you really want to criticize these members of the international ham family, just because you had the privilege to be born into an easier world?

Roger A.U. Jung HB9BBR
Switzerland

Having visited 120 countries so far, my interest isn't in remaking them like America as much as seeing them and understanding them. I reported on what I saw and experienced...Wayne

Times Have Changed

I enjoy doing a variety of things within the amateur arena. Sure don't care for the B.S. that clutters up the low bands... sure enjoyed the days when you could get into a good technical conversation with another amateur. I know with the high-tech aspect of equipment these days it requires more study and time, but the rewards are worth it. Of course, the experimenters, innovators and real gentlemen of ham radio are out there, it's just more difficult to find them sometimes.

Bill Tipton W4TAL/NNN0LLX
Navy-Marine Corps MARS
Jacksonville AL

70cm Concern

We have received correspondence from a VE3CAB SAAC News Release alerting us to the fact that the Canadian DOC intends to re-classify a meteorlogical Clear Air Doppler Radar (CADR). Its present operating area is 404.37 MHz and it will be relocated in the 430-450 MHz 70cm amateur radio UHF band. This system, we understand transmits high-power, triple beam, broadband radar pulses.

We are very concerned about the proposed move to these transmitting devices on our northern boarders as it will almost wipe out and QRM the entire 70cm UHF amateur band. It will also disrupt all present modes of FM, SSB, ATV OSCAR, packet, and EME communications! Likewise, if this system is allowed to relocate without challenge, it is just a matter of time before the US will be pressured to endorse such a relocation as well. This will put the highly used 70cm amateur radio band into serious jeopardy!

What is the reason given for this Canadian move? We feel it is a longer range plot to overtake the 70cm amateur UHF band. We have already lost a vast amount of usable frequency spectrum to the LINE-A restrictions placed upon us. We cannot afford to lose any more!

Mike Stone WB0QCD
USATVS
Editor SPEC-COM

Who Wants the Hot Potato?

The FCC has said that recognized coordinators will decide the right to use a given repeater frequency. Great in theory, but who is the recognized frequency coordinator?

Several questions come to mind.

1. Who picks the coordinator?
2. Who determines who is a coordinator?
3. What are the qualifications to be a coordinator?
4. What other factors are to be considered when determining who is the frequency coordinator?

Some hams have suggested that the ARRL act as the coordinators' coordinator. Their answer: No way. Some have suggested the FCC should take a more active role. Their answer: No personnel, no money, and perhaps no care. Let's throw the names in a hat and have a lottery. Why have rules, tests, or even licenses? If nobody cares let's have a ball and we will have the 11-meter mess again.

I don't see Commission lawyers donating any time to the problem. They want to be paid for their time.

Who is going to coordinate the appointment of the arbitrators? What is to be the arbitrators' qualifications? Will the arbitration be binding? Who will defend the arbitrator if he gets sued? (California, with an arbitration statute gives them immunity, but tell that to a bull-headed amateur.) What about any financial liability? Who is going to develop the forms, rules, procedure, and handle the paper work?

Nice idea but... I guess we might do it the Old West way: He who has the highest mountain and the biggest amplifier gets the frequency or maybe we will go back to the old repeater wars.

Oh well, welcome to the new Citizen's Band radio. Uncle Charlie old buddy, you really have a hot potato, with lots of potential law suits. I suggest you "Tell it to the Judge," when you are sued, to enforce Part 97.

Joseph Merdler N6AHU
Atty At Law
Los Angeles CA

QRP Confusion

ARRL recommends 7040 kHz for "RTTY DX" while Mike Bryce, representing *73*, calls 7040 kHz "the QRP calling frequency..." My guess is that this co-use of the frequency is pretty hard on the little guys, viz., QRP'ers.

Frank R. Prina N2DLN
Springville NY

Tone Decoder Notes

I'd like to make the following clarifications regarding my 4+1 DTMF decoder (April issue).

The present circuit may not decode tones if the receiver's volume control is set too high. This problem can be reduced by replacing C1 (0.01µf) with a 1kΩ resistor in series with a 0.01µf capacitor. Also, the brightness of LED can be increased by reducing R1. R1 can be as low as 100Ω, depending upon the LED.

If the Midland Technologies PC board is used, note that R9 is wired clockwise to decrease the speaker on time.

Finally, many people spend too much for tone decoder chips. The SSI-202 sometimes sells for $15 or more. The equivalent chip, the RCA CD22204, is sold by RCA distributers in single lots for $4.50. If local distributors do not stock the CD22204, and the builder does not want to wait 12 weeks for delivery, the chip is available through Circuit Specialists (P.O. Box 3047, Scottsdale, AZ 85257) for about $6.

Andrew Mitz WA3LTJ
Kensington, MD

Down Under No-Code

I would like to point out an error in the *QRX* page in the December 1987 issue (only recently received!). Under the heading of "Aussie Novice 2m Phone?", you incorrectly state that "Australia still has no-code license class." Permit me to point out that Australia has had a no-code license class since about 1959, when the "Limited" class license was introduced. It can therefore be seen that Australia has had a no-code licence for something like 30 years, along with many other countries!

Basically, the "Limited" call allows full power and modes on all bands above 30 MHz, and indeed, much of the pioneering work on these bands was performed by these "Z" calls. Why are they called "Z" calls? Under the Australian licensing scheme, "Limited" calls were issued with the series "VKnZAA" to "VKnZZZ", subsequently extended to "Y" suffixes, then "X" suffixes, and now "T" suffixes.

David I. Horsfall VK2KFU
Australia

Computerized CW

I have noticed that CW is not one of Wayne's favorite operating modes. (In fact, it probably does not have a spot on a lot of people's lists of operations.) However, I recently discovered the pleasures of CW via my computer. It is a very interesting way to get on the air.

My XYL gave me an AEA PK-232 for Christmas, and I have had a great time with packet, RTTY, and CW. This morning I had a 45-minute QSO with a local ham on 40m CW. We operated at 30 wpm and discussed antennas, the local ham politics, antenna projects, power supplies, etc.

Dust off your computer and try some computerized CW. I'll bet you enjoy it (despite yourself).

Tom Hart AD1B
Dedham, MA

Circuit Correction

I started building your circuit "Beacon Transmitter" in the April 1988 issue and found that there is a slight problem. In order to get the circuit to oscillate, you need to connect pin #6 to pin #2 on both IC-1 and IC-2. The way it is set up now, the circuit is in the monostable mode and needs a trigger to keep it going. With pin #6 and pin #2 connected, the circuit is in the astable mode and the oscillator will be free running.

Duane Tuma KA9UMM
Carpentersville, IL

Number 37 on your Feedback card

OP ED

by Larry Ledlow, Jr. NA5E

Promoting the Higher Bands

Apparently, most hams' ideas of DX involve the HF bands. Ask a ham to describe what it's like to operate above 30 MHz, and more often than not you'll hear terms like "two meters," "FM" and "repeaters." We have ourselves to blame for perpetuating such narrow views of hamming. We humans sure are creatures of habit. Well, when the language gets too bad on the local two meter machine, or when you get hoarse from yelling into a pileup on 20 meters, think long and hard about exploring some of the many (albeit poorly publicized) possibilities on the VHF and UHF bands.

> ***"Do you think any of these guys would work so hard to turn on these bands if there wasn't any DX action and excitement on VHF and UHF?"***

DX and Contests

Beauty, of course, is in the eye of the beholder, and so is DX. Those two letters, which make up the most popular term in the ham radio lexicon, definitely take on new meaning and present fantastically fun challenges above 30 MHz. Whether chasing countries, zones, states, or grid squares, the DXer gets a kick from working a new one. The tally is a testimony to his or her tenacity and skill. VHF DX is no different.

Six meters usually receives a lot of attention during a few years of every solar cycle. Sporadic E propagation occurs each year, but when the solar index begins to peak, six meters can support worldwide contacts. DXCC and *73*'s DX Dynasty Award on six are becoming relatively easy to obtain, too, since more countries are adopting amateur radio allocations on this band.

More and more DXpeditions these days take along gear for six meters. For example, both Jim Treybig W6JKV on Aruba and Harry Schools KA3B on St. Pierre will have six meter gear turned on for the June 11–12 VHF QSO Party. Bart Jahnke KB9NM will activate 4U1UN on 50 through 2304 MHz (!) for the contest, too. (Don't forget that 4U1UN counts for DXDA and DXCC country credit. It is also in grid square FN30). July 7–14 will also see some HF and six meter activity from PJ0M, courtesy of the Six Meter DX Society.

Two and 1.25 meters and 70cm usually come alive with DX activity during the summer, too. Most DX action here is due to tropospheric ducting, which actually occurs with great regularity during the warmest months. Contacts over several hundred miles are very common, even on a bad day. When I lived in the UK, I regularly worked two meters into France, Germany, Switzerland, Scandanavia, and even Eastern Europe using 25 watts from my IC-290H and a single KLM-13LBA antenna. (Get Wayne to tell you about his two meter exploits 40 years ago. Now *that's* DX.) Although the majority of DX contacts involve SSB and CW, try giving a shout on 145.52 FM simplex once in a while.

Our own Pete Putman KT2B and company will take advantage of the generally good VHF and UHF summer conditions along the East Coast to operate in the June QSO Party from Chincoteague Island (grid FM27). His group plans an impressive operation on 50, 144, 220, 430, 903, 1296, and 2304 MHz. Do you think any of these guys would work so hard to turn on these bands if there wasn't any DX action and excitement on VHF and UHF?

Modest Requirements

No, you don't need to go out and spend a zillion dollars on good VHF/UHF gear. You can get perfectly acceptable results with transverters, which will take an SSB signal from, say, your HF rig, translate it to a higher frequency, and downconvert VHF/UHF signals for reception on the HF rig. Many transverters come in kit form, but others are already assembled. You don't need kilowatts of power to have a respectable signal on the higher bands, either. One or 200 watts is serious RF at these frequencies, and a modest VHF amplifier costs about one tenth the price of an HF amplifier.

I like to work at VHF and UHF, because the erection of a high gain antenna system doesn't require a great deal of real estate or manpower. Rotor systems are smaller, too.

All in all, you keep the costs down with smaller system requirements. Take a look at previous "Above and Beyond" columns to see how inexpensively you can get on the other bands.

Campaign for 902 MHz

Not long ago I asked a few hams if they knew of any activity in their area on the 33cm band. More than one answered with something like, "You mean 1296? Nah." No, I meant 33cm, not 23. "*That's* not a ham band . . . is it?" All together, now, turn to Section 97.61 of the Amateur Radio Service Rules and Regulations. Yes, the 902–928 MHz band is allocated to amateur radio.

> ***"Think long and hard about exploring some of the many (albeit poorly publicized) possibilities on the VHF and UHF bands."***

Take a look at the 1987–88 *ARRL Repeater Directory*. You'll find a handful of 900 MHz ATV repeaters and two-and-a-half dozen FM repeaters scattered from Massachusetts to California. Disappointing, to say the least, but understandable considering the lack of readily available 900 MHz equipment. Certainly the Big Three amateur radio manufacturers don't support 902 MHz, and I've only come across a couple of 33cm transverters in the past several years.

I don't get it. We go to all the trouble to get a 902 MHz allocation from WARC, and hardly anyone takes advantage of it! You'd better believe that 902 MHz is next on the commercial interest hit list. They'll be after that band once they get 220 MHz.

I had a nice chat the other day on 70cm with Harry Chase WA1VVH. Harry's got the UHF bug, and he's doing a lot of interesting work on 902 and 1296 MHz. In fact, Harry is custodian of the 919.10 MHz repeater in Pepperell, MA. He expressed disappointment at the lack of press 902 MHz gets. I have been pro-902 from the beginning, and I thought Harry brought up some valid points. I think *73* should do its bit to promote activity on 33cm.

There's a great lack of detailed information on groups actually involved with 33cm work. I know of a few ATV and repeater clubs, and packeteers are investigating high-speed networks on this band. Most of these groups operate in relative isolation, however. We need to document and keep track of all the activity on 902 MHz to aid and encourage these groups' work. Also, a central source of 33cm material would help dispel the notion that there's no activity on the band. This will be very important when the FCC accepts a petition from a commercial interest group to take the 33cm band away from us.

Thus, we have two main goals for the "73 for 33" campaign. We need an individual or group to coordinate and disseminate 33cm information, and to keep 902 MHz enthusiasts in touch with each other. Then, of course, we need the shakers and movers at 902 to start writing articles promoting the band. Since there is little commercial gear available, I expect quite a few good 33cm projects to grace the pages of *73*. Get busy and start writing!

Is this just a 902 MHz pie in the sky? Well, that's what a lot of people thought about Wayne's push for FM repeaters 20 years ago. Sometime around 1998, when I ask hams to describe the activity on VHF and UHF, I expect to hear things like "digital ATV," "40 megabaud," and even "902 MHz." Remember, 73 for 33! ■

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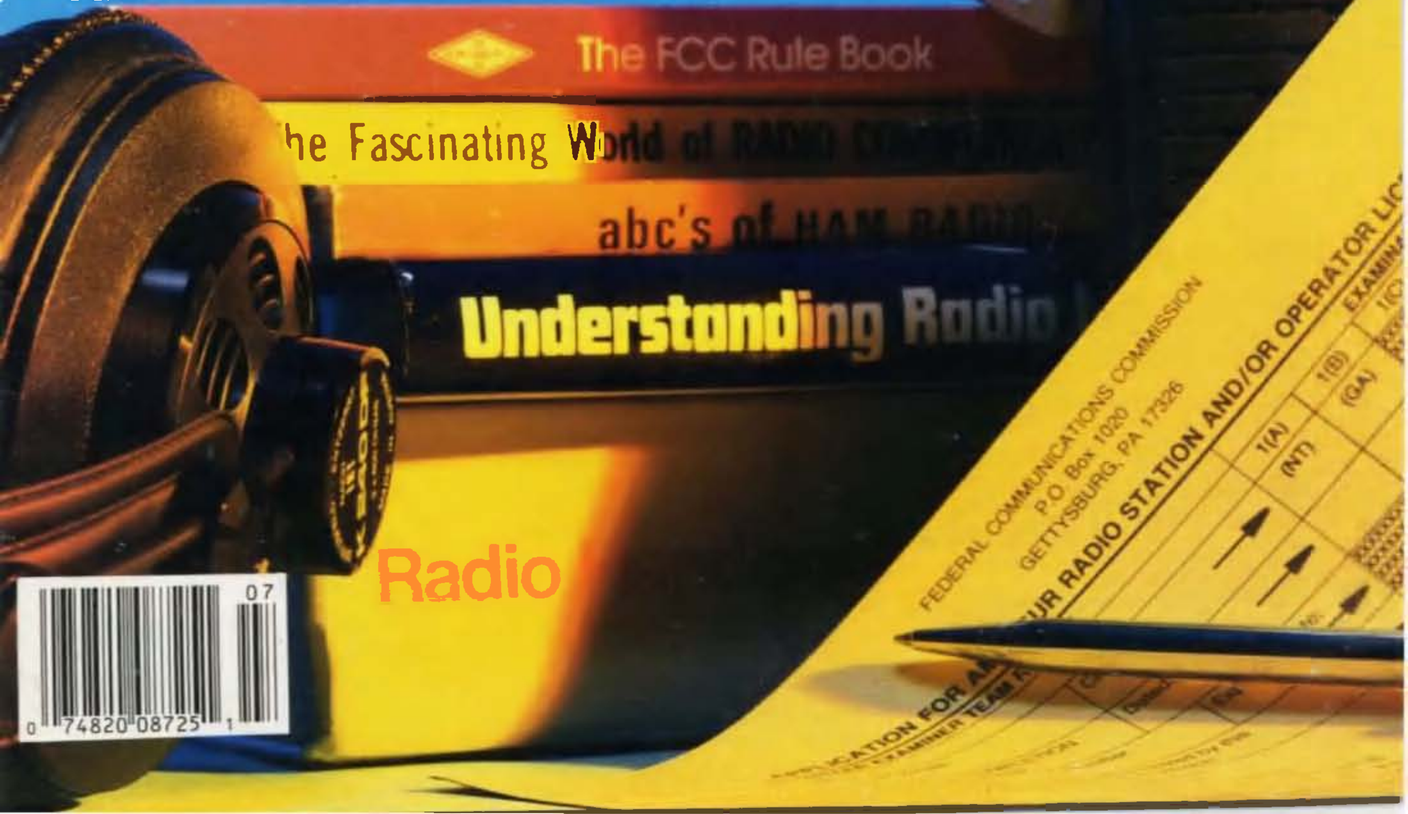

Welcome, Newcomers!

WHY BECOME A HAM?

For many people, the first question is: What is a ham? A "ham" (amateur radio operator), is someone who has the right to transmit on the amateur radio bands.

The public often mixes ham radio and CB radio. They are right in principle—both involve transmitting and receiving radio signals—but CB radio offers only a glimmer of the kaleidoscope of radio communications hams have at their disposal. Hams routinely talk with other hams the world over, in a variety of modes and on a variety of bands. Hams can extend the range of their signal through increased signal strength, mode choice, and through repeaters—even through satellites!

How To Become a Ham

Becoming an amateur, however, is just not a matter of buying the ticket. The aspiring ham needs to pass an examination consisting of two elements. The first is a written exam on radio theory, rules, and regulations. The other element consists of listening to and copying (writing down) Morse code. If he passes both elements, this information is submitted to the FCC, who sends him his license at no cost in 6 weeks' time.

How difficult is this? It's important to first set the test date to aim for. There are enough VE test centers that chances are very good there's an exam session on the average of once a month at a center within a hundred miles of you. Contact the American Radio Relay League in Newington, Connecticut, for a list of these test centers.

For the entry-level license—the Novice Class license—a typical applicant should begin to study daily one month before the test date. The typical applicant will in reality need only half this amount of time or less, so the extra time is insurance for confidence. The daily study routine is 45 minutes for theory, rules, and regulations and two periods of 20 minutes each to copy code.

Morse Code

Aspirants seem to have the most trouble learning the code. Many have a hard time committing themselves to learning it because they don't see the sense in learning a mode which conveys information so slowly, and which many people condemn as archaic in the face of newer, more sophisticated, modes. There's even a lot of talk about creating a no-code license amateur license in the US, and Canada is taking steps toward a no-code license, scheduled to take effect next year.

On the other hand, Morse code remains the best combination of simplicity of production and transmission, and effectiveness in conveying information during poor propagation. (See *Welcome, Newcomers* in the April 1987 issue for details.)

Your feelings about the code, however, don't change the fact that it's still an exam requirement. If you're anti-code but want your ham license (and don't want to wait for the requirements to change)—compartmentalize your feelings. Concentrate on learning it for the exam, and *then*, if you still feel strongly against it, join the campaign for a no-code license.

Code learning and copying, like many rote exercises, can quickly fatigue you at first. Our minds have a way of rebelling against learning something that doesn't give us the stimulation of reasoning. Many perfectly capable people have themselves convinced that they are unable to learn the code. Their mistake is that they confuse mental *incapability* with mental *blocks*.

How do you deal with this? By learning in frequent but *small* doses. I am not an ardent fan of code, but I learned it best when I ended my practice sessions early, often times before I even felt like it. This kept my mind open for the next session.

This month's July issue has a number of articles packed with pointers on how to learn the code. There's an excellent article for Novice aspirants who clutch under the "real-time" demand of copying code as it's sent—it teaches you how to copy the tones, which you can decipher at your own pace after the sending session!

See you on the bands come September!

. . . de KA1HY

GLOSSARY

Ham Radio—There are many explanations of the origin of "Ham" Radio. One theory holds that, in the days of the peak use of telegraphy, a "ham" referred to a poor operator, which radio operators humorously adopted! Another explanation holds that it's just an abbreviation of "amateur."

Radio communication—Radio is used here in its broader meaning. A radio wave is an electromagnetic wave that travels through a medium, such as air. They are described in terms of either **frequency**—the number of cycles of that wave that pass a fixed point in a given amount of time, or **wavelength**—the distance from one peak to the next peak of that wave. An RF (radio-frequency) wave has a wavelength range of 30 kilometers to 1 millimeter, which corresponds to a frequency range of 10,000–3 million million **Hertz** (cycles per second).

Radio communications refers to any sort of information that's conveyed on RF waves. Hams are allowed to encode RF waves in many forms, including voice, radioteletype, and video.

Mode—This describes both the kind of information encoded on a radio wave *and* the modulation method used. For example, stations on the AM broadcast band are both voice mode (the kind of information) and Amplitude Modulated (AM) mode (modulation method). Stations on the FM broadcast band are also voice mode, but thier modulation mode is Frequency Modulation (FM).

Band—A segment of the Radio Frequency spectrum.

Repeater—An unmanned transmit/receive site that receives an FM signal and simultaneously retransmits it on another frequency. This increases the range of a signal.

Ticket—Ham jargon for the license to transmit on the amateur bands.

FCC—Federal Communications Commission. The US government agency responsible for the allocations of frequencies for radiocommunications and broadcasting in the US.

VE—Volunteer Examiner. This is a ham who holds an Advanced Class or Extra Class license who has been accepted by a Volunteer Examination Coordination body to administer exam sessions. Until recently, the FCC directly administered amateur exams.

Propagation—Refers to the conveyance of an electro-magnetic wave through a medium, such as the atmosphere. The better the propagation, the further the wave travels.

QRM

Editorial Offices
WGE Center
Peterborough NH 03458-1194
phone: 603-525-4201

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Contractual Agreement: Just your breath—did you use Scope today?—on this magazine enters your body and soul into contract with the Spirit of Amateur Radio. Hereafter you will promote this hobby with the fervor of a religious zealot. You will recruit no fewer than ten new hams in the next six months, you will carry out at least one public service act within the next year, and you will solder something once each week for the rest of your life. Above all, you must regularly report your progress to the editors of this magazine through feedback cards, letters, or electronic means. We'll be watching you!

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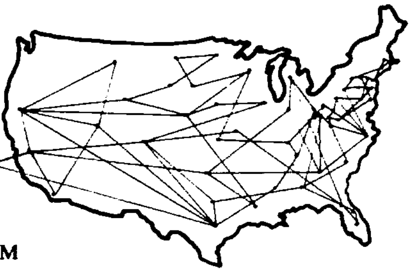
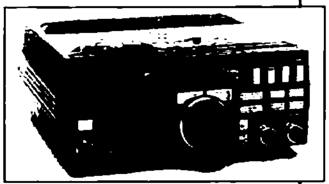


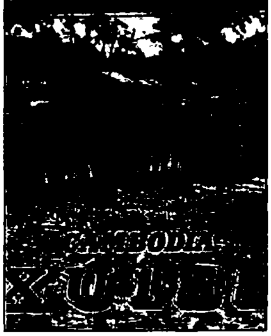


W5YI - VEC
HAM IT UP!
VOLUNTEER EXAMINING

REVIEWS

DEPARTMENTS

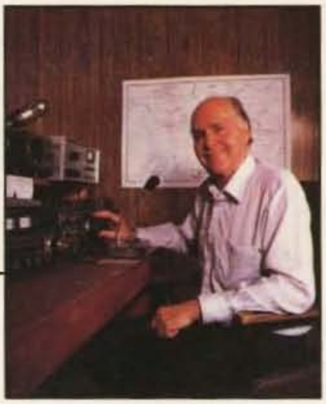
FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 89! You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to 73!



Cover by Deborah Smith
Photography by Suzanne Torsheya

Number 2 on your Feedback card

NEVER SAY DIE



Why Posthumous Awards?

Bill Bennett W7PHO, a DX legend, died recently. Something about the move to honor him at the Dayton Hamvention just didn't set right with me. There wasn't anything wrong with honoring the years of service Bill gave to our hobby. Yet something bothered me.

As usual, my thinking came together when I was taking a shower. I suddenly knew what was wrong. Why in the devil are we going to honor Bill after he's dead? That's crazy! It isn't like we didn't have quite a few years to think of this while he was alive and tell him how we felt. Then he could have known of our appreciation for all his work and gotten some satisfaction out of it. These posthumous honors are for the birds.

This came home to me even more a few days ago when Bill Hoisington K1CLL died. Bill wrote dozens of articles on simple-to-construct ham equipment. He was an absolute wizard at knocking together gear for any band right on up through 3,000 MHz on his kitchen table, using nothing more than a couple of low cost transistors. His rigs would light a light bulb, even at those frequencies.

I first ran into Bill K1CLL when he was operating on 2m from a fire tower on a Rye, New York, mountain. He was W2BAV then. His W2BAV VHF antennas were state of the art. Indeed, I used one of his 16-element beams when I operated from the top of the News Building on 42nd Street in Manhattan. I used to talk with Bill frequently as we vied for DX contacts on 2m. That was back in 1948, forty years ago.

When Bill got to be around 62 years old, over twenty years ago, my understanding is that he was suddenly fired from his electronic technician job by his employer so they wouldn't have to pension him at 65. Diamond Tool and Horseshoe Company, as I recall. Bill got in touch with me and proposed a series of articles on home construction for *73*. Fine with me.

So Bill moved to Peterborough and bought a farm so he could be near *73*. He produced endless articles that thousands of readers enjoyed and built. He designed simple receivers, transmitters, amplifiers, test equipment and so on.

He was fortunate enough to get divorced from a rather nasty second wife. The next thing I knew he went to the Philippines to marry a woman who wanted to move to the US. He brought her back, got divorced, and wrote more articles.

Then he developed cancer. The doctors told him nothing could be done—hopeless. So he went back to the Philippines to see a psychic healer, threw off the cancer and married a lovely Philippine woman, Pilar. I heard off and on from him from Manila, where he was living happily.

Six years ago, when I visited Manila, I tried to find him. The local hams said he'd gone back to the States. Sure enough, he turned up in Peterborough a year later. Moved here with Pilar. He had been recently working with the *73* editors on a new series of simple construction projects. He was a genius at that, always able to use easy-to-get parts that he'd put together in a novel way. Ham radio suffered a great loss when Bill died of a heart attack a few days ago.

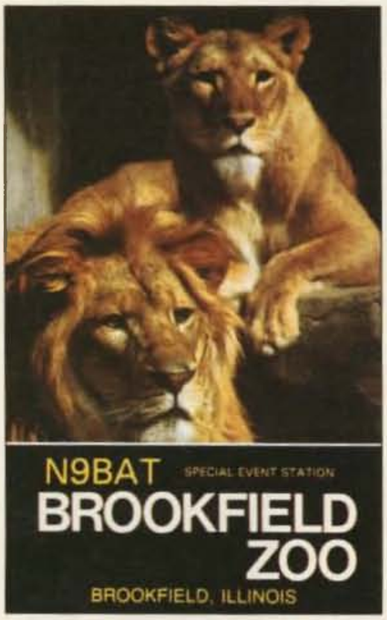
Too Late for Thanks

I wonder how many readers who enjoyed Bill's articles ever wrote to thank him?

So I got to thinking about W7PHO, who should have been honored while he could have enjoyed it. And K1CLL, too. And then I began to think of all the other outstanding hams we've ignored while they were alive.

The father of RTTY was John Williams W2BFD, a particular friend of mine. I doubt if we ever would have had RTTY without John. He did the early hard work of locating Teletype machines and getting them released for ham

Continued on page 46



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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GRAPHICS PHOTOGRAPHER
Dan Croteau

Editorial Offices
WGE Center
Peterborough, NH 03458-1194
603-525-4201

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QRX . . .

EDITED BY BRYAN HASTINGS KA1HY

Phase 3C

At press time, Arianespace, the European Space Agency, announced that the launch of AMSAT Phase 3C was set for June 8th. The P3-C satellite has three transponders on board as well as the RUDAK digital packet communications experiment. AMSAT-NA advises the following revised Phase 3-C operating frequencies.

Mode "B" (50 Watts PEP)
Input (Uplink): 435.420–435.570 MHz
Output (Downlink): 145.825–145.975 MHz
General Beacon: 145.812 MHz (CW/RTTY)
Engineering Beacon: 145.985 MHz

Mode "L" (Primary Transponder)
Input (Uplink): 1269.62–1269.33 MHz
Output (Downlink): 435.715–436.005 MHz
General Beacon: 435.651 MHz (PSK/CW/RTTY)

Mode "JL" (Secondary Transponder)
Input (Uplink): 144.425–144.475 MHz (50 kHz)
Output (Downlink): 435.990–435.940 MHz

Mode "S"
Input (Uplink): 435.601–435.637 MHz
Output (Downlink): 2400.711–2400.747 MHz
General Beacon: 2400.325 MHz

RUDAK is a world-wide independent packet data channel using separate receive and transmit frequencies. (Mode "L" 50W PEP)
Input (Uplink): 1269.70 MHz (2400 bits/second DPSK)
Output (Downlink): 435.677 MHz (400 bits/second PSK)
The RUDAK packet message project is the brainchild of Hanspeter Kuhlen DK1YQ.

JARL

The Japanese Amateur Radio League has released a reevaluated band plan for the spectrum from 50 MHz to 10.4 GHz. It matches much more closely than their previous plan the bandplans stipulated for the three IARU Regions. Another key point is that data and image communications will each have two exclusive mode segments: SSB and FM.

Canada Packet

The Canadian Department of Communications encourages packet radio operation in that country. The DOC informed the CRRL that it has no objection to amateurs holding an Advanced Amateur certificate, or a certificate with a six-month endorsement, operating packet radio on frequencies recommended by the ARRL Ad-Hoc committee on amateur radio digital communications. No amateur radio group, including the CRRL, solicited this statement. It's a natural step, since the DOC has routinely given individual amateurs special authorization to operate on these frequencies.

Broadcasting OK

The FCC won't limit the broadcast time of an amateur station issuing bona-fide news bulletins, as long as these narrowcasts or QSTs are directed only at the amateur community. The Commission states this in its decision to turn down a rule-making proposal filed by James Fisher K4GF of Ocala, FL. James K4GF proposed to limit amateur broadcasting—"bulletin mode"—to ten minutes per day. The FCC's reasons for refusing the proposal:

- There is no proof that the broadcasts cause sufficient congestion on the ham bands.

- Bulletins serve the amateur community by providing an effective means of keeping hams informed about their service.

Amateur broadcasts were officially sanctioned 40 years ago, as the result of the 1948 Docket #8918, which led to the establishment of rules that permit hams to issue one-way transmissions.

W7PHO Honor

Bill Bennett W7PHO is the first ham to posthumously receive the Dayton Amateur Radio Association "Radio Amateur of the Year" award. Bill is honored for his years of dedication to Amateur radio, especially DXing.
Bill's most notable achievements are the creation of the Western Washington DX Club, and the DX Family Hour Net. He also worked closely with the ARRL to establish their outgoing DX QSL Bureau. Bill W7PHO died at age 78 on December 23rd in Seattle.

900 MHz

The FCC authorized the Association of American Railroads to use six conventional 900 MHz frequency pairs for an "Advanced Train Control System." These are located in the 896–901 and 935–940 MHz bands. Although this system will mainly be used for digital information on the position, speed, and other vital statistics of the train, it will also have voice capability.
This a good opportunity for equipment manufacturers to target two markets at once. They could produce radios that will easily modify to amateur use on the 33cm band.

70cm Infringement

Northern Hydraulics, Inc., a mail-order business in Burnsville, Minnesota, is marketing an Amateur HT to use as a no-license CB radio. The "Eagle" HT operates on the 440–449 MHz band. In their Sale Catalog #46, they suggest using this HT for business purposes: "A real time and work saver for surveying, construction, highway, and field work coordinating." They do state that the unit is FCC Approved, but don't state that any sort of license is needed to operate the unit.
Many hams have called their toll-free number (800-533-5545) to inform them that their presentation of this radio promotes illegal use. The company has so far ignored complaints.

Send'em In!

QRX readers may have noticed the paucity of photos in this column recently. It's very simple—we can't print what we don't have to print!
We will review any graphics related to Amateur radio, however remotely. High-contrast color photos are preferred. Send in your photos for the ham community to see!

Articles!

What's happening on 33cm? Why does over 20 MHz of this band lay fallow? Think of the possibilities, especially for high speed data transfer, on this little-used stretch of spectrum! *73 Magazine* is especially interested in promoting use of the 33cm (902–928 MHz) band, and intends to run a theme issue on what's happening on that band in the not-too-distant future. We are looking for articles, reveiws, and other text items.
Let's make 19.2 KB and above digital communications a reality for many more hams!

Reprints

If you are interested in obtaining article reprints from *73*, call or write Linda Reneau at *73* Editorial, (603) 525-4201, Ex. 551. Reprints are $3 for the first reprint and $1.50 for each additional. Pay with cash, credit card, or check.

That's All, Folks

Thanks for this month's **QRX** items go to: *Westlink*, *W5YI Report*, AMSAT, and *CAREN's World*. Keep your photos and news items rolling in to: *73 Magazine, 70 Rte. 202N, Peterborough, NH 03458-1194. Attn: QRX*

Co[redacted]e Test Sur[redacted] Shot

Legally pass [redacted]ithout learning Morse Code!

by [redacted]arold Love KA0NTK (SK)

It's possible to pass the Novi[redacted]ode exam if the examinee knows it at [redacted] less than 5 words per minute. It's possible to legally pass even without knowing the entire Morse code, or even most of it. This article tells how. The techniques described here may also be useful for those who are taking the test and have actually learned the code, since they will virtually ensure success on the code exam.

In The Middle

I approach this topic with some trepidation, since I am sure that I will anger a number of people by showing how to pass the exam without learning the code. On the other hand, for those in favor of a no-code license, this article will probably not go far enough, since it still requires sitting down and taking the exam. Those in favor of the code exam should console themselves. This technique will *not work* for passing the 13 or 20 wpm exams.

Those in favor of no code test at all: You can learn everything you need to know to pass the 5 wpm code test in a couple of hours!

Test Format

In order to understand how it's possible to pass the test without learning the code, the aspirant must first understand the nature of the Novice code test. It consists generally of ten fill-in-the-blank questions about the content of five minutes of QSO-type code transmission. Five minutes at five words per minute is the equivalent of only 25 five-letter words. If all of the characters transmitted were letters, that would be 125 letters. But numbers, punctuation, and prosigns count as two letters, so the actual number of characters transmitted in a Novice code test is really around 110. With this small number of elements, the examiner doesn't have much choice about what kinds of questions to make up, so they are relatively easy to anticipate.

The text itself is in a conversation (QSO) format. Therefore, the first characters sent make up the station callsigns of the stations involved—"(His call) DE (Your call)." These are repeated at the sign-off, the end of the transmission. The test-taker can also count on hearing the Readability/Strength/Tone (RST) signal report, and most likely the operator's name.

The FCC insists that every letter, number, and punctuation mark be included in every test. The Volunteer Examination Coordinators (VECs) have so far unsuccessfully tried to talk the FCC out of this. The FCC likely wants to prevent the make-up of a really easy test that doesn't include the harder letters and punctuation marks. Actually, the all-character inclusion works in favor of the test taker because it makes it easier to predict what will be on the exam.

> ***"You can learn everything you need to know to pass the 5 wpm code test in a couple of hours!"***

How are all of the ten numbers used? The callsigns account for three of the numbers (because one of the callsigns will undoubtedly be portable in another call district, since this is about the only way to work in the required "/" sign), and the signal report accounts for another three (the last of which will almost certainly be a 9). The four remaining numbers will likely be used for the operator's age, temperature, transmitter power in watts, and the number of years the operator has been licensed. Since there is so little information in a five word-per-minute test (because it is so brief), if these items are included in the code transmission, they will have to be included in the fill-in-the-blank questions.

- Callsi[redacted] the two stations
- RST R[redacted]
- At least one of the operator's names
- Two of three of the following: age, temperature, power, and years licensed.

Right away it's possible to predict at least six of the ten questions on the exam. Seven correct or better gives a passing grade.

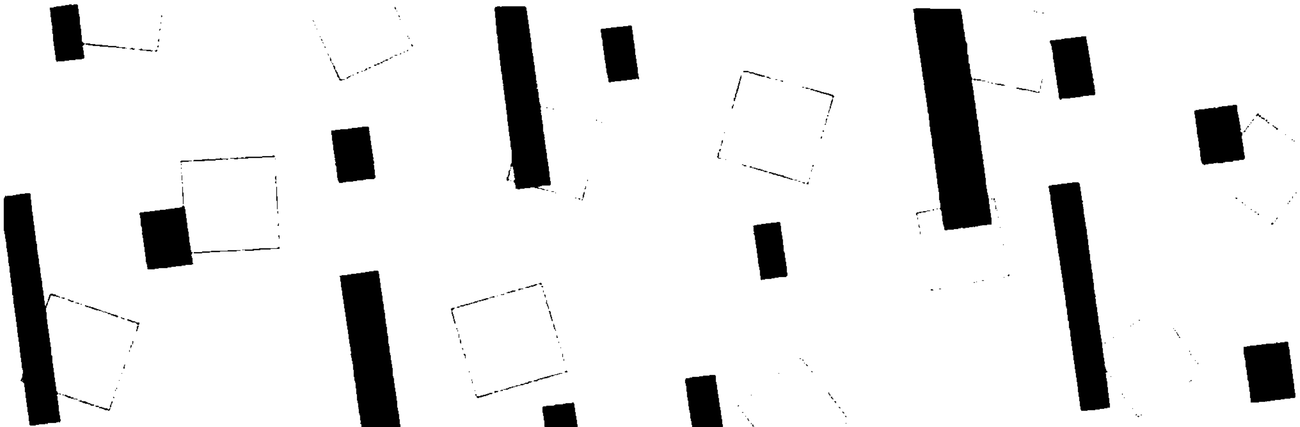
Make A Grid

Bear in mind that most examiners allow test takers time after the code transmission to fill in any blanks and get their test paper into shape. The time limit applies only to the five minutes of the code transmittion, not answering the 10 questions.

The trick, then, is to not copy the characters represented by the dits and dahs (dots and dashes), but the dits and dahs *themselves*!

First, before the test starts, draw a grid on the copy paper made up of seven vertical and thirteen horizontal lines. It's easiest to do this with a full-sized (8 ½ x 11 inch) sheet of unlined paper. This gives fourteen rows of eight squares, or 112 squares altogether.

Each time a character is transmitted during the test, write down in each grid square the dits and dahs exactly as heard. It's possible to separate characters, because they have longer spaces between them than the spaces between dits and dahs within a character. Make a short vertical stroke for a dit and a longer vertical stroke for a dah. It's much faster to draw a vertical than a horizontal stroke. Put one character in each of the boxes. If the test code transmission uses the Farnsworth system, in which the letters are transmitted at high speed with long spaces between them, the easiest way to record them is to wait until each character is sent and then make the marks. If the code is sent at a straight 5 wpm spacing, it will be easier to write each dit and dah as it is sent. Don't convert the characters into letters and numbers even if you know which ones they are, because this will slow you down—*write down exactly what you hear*.



It will also be useful, though not nec[redacted]y, to make a heavier or longer mark for [redacted]r spaces that seem to indicate the end of [redacted].

At the end of the exam, write the entire alphabet and set of numbers (1-0) down on another sheet of paper. The test taker does need to know some of the simpler letters. In working with someone who knew absolutely no code, I found I could easily teach him the following letters in about 1 hour: E, I, S, H, T, M, O, A, W, J, N, D, B, and R.

E is the most common letter in text, and it has the simplest Morse code symbol—one dit. The first four letters of this group can be classified as being similar to e—that is, they are "e-ish." Using the mnemonic "e-ish" recalls the first four letters. E is one dit, I is two, S is three, and H is four. The next three letters T, M, and O, are composed solely of dahs, so they take more oomph to write (get it. . . Take More Oomph). T is one dah, M is two, and O is three.

Just use these two simple mnemonics and translate the short and long strokes at (relative) leisure after the code test transmission.

The only characters left to learn are numbers—which takes about 30 seconds. All are five tones long, in a combination of dits and dahs. They follow a distinct pattern. The number one is a dit followed by four dahs. The number two is two dits followed by three dahs. This pattern continues to five, which is five dits. Six is a dah followed by four dits, seven is two dahs followed by three dits. This pattern continues to 10, which is five dahs.

Like Puzzles?

Remember, it's not necessary to know these letters and numbers fast—just be able to recognize them on the grid system.

The next step is to write down the symbols for all the known letters and numbers on the alphabet list. Now go back to the test paper and fill in all of the Morse code characters that you can. Try to see the exam like a cryptogram, solving for the unknown items.

First (after the repeated Vs that start the test), the transmission will begin with callsigns, since it is a QSO-type test. Every test that I've seen so far only uses US callsigns, and they must begin with N, W, A, or K. All but one—K—are on the above list to memorize. The two callsigns will be separated by the word "DE," composed of two of the memorized letters, so the first letter after "DE" must, again, be N, W, A, or K. If a callsign e[redacted]in a number [redacted]d one of them probably [redacted], then the s[redacted]ol before the number is a slant bar.

The single most importan[redacted]rd in the text is the word "is." This is be[redacted]e it is almost always the case that the wor[redacted]er "is" will be the answer to one of the[redacted] questions. Thus, the following copy, "A[redacted]E IS 26." is easily deciphered as the operator's age. The missing letter is "G."

> ***". . . most examiners allow test takers time after the code transmission to fill in any blanks and get their test paper into shape."***

Similarly, "TRANSMITTER IS _ENWOOD." answers the question about the rig brand. It helps to be familiar with the names of major Amateur transceiver companies: ICOM, Kenwood, Yaesu, Heathkit, Ten-Tec, Drake. R_NNIN_ 200 WATTS gives info on how much power the transmitter is running, and deciphering the rest of the message teaches the symbols U and G. There are a number of other possibilities.

The next step is to take the letters you don't know but have been able to decipher and add them to the alphabet list, then carefully fill them in wherever else they appear in the text. Finally, it may be possible to fill in yet more of them because in the Novice test there are so few characters. If all numbers, punctuation, and prosigns count as double, and they all must be included, then the maximum number of characters that can be transmitted in five minutes is 109. There are 42 different numbers, letters, punctuation marks, and prosigns. Thus, only 69 of the characters can be duplicates, and most of those duplicates will be vowels, since all words contain vowels. Furthermore, since the callsigns are repeated at the end of the transmission, this cuts out about 10 more characters as duplicates. Thus, it is highly unlikely that rare letters, such as Z, Q, and X will be repeated, unless in the callsigns. The process of elimination can determine a few more letters.

Now see how many questions you can answer. With luck, one of the callsigns will contain only memorized or deciphered letters, but don't count on this. Thus, be prepared to answer seven of the remaining eight questions correctly. One of the questions will probably be the name of one of the two operators. Two general rules will help with this. First, with the copy, NAME IS BI____, it's a sure thing the name is Bill, *and* that Bill is the name of the operator doing the transmitting since no one says in a QSO, "YOUR NAME IS BILL." Secondly, if there are clearly two names in the text, it's a reasonably sure bet that the first one is the name of the operator being transmitted to, and the second is the name of the operator doing the transmitting. In QSOs, almost everyone says the other person's name first.

Another piece of information that may appear is the operator's license class. Look for words like NO_I_E, _ENERA_ or E_TRA that may be the answer to that question.

Final Words

Is it possible to pass the exam without actually learning the Morse code? In nine out of ten cases, yes. It's hard to imagine that it would take more than two tries using this technique, and again, this is a technique that can easily be learned in an hour or two.

One word of warning: This method doesn't prepare an operator to actually have CW QSOs. Real QSOs demand "real-time" knowledge of the code. I suggest learning the code in earnest, because not only is Morse code fun (once you get your speed up to 15 words per minute or so), but it provides an opportunity to work DX stations not available on the phone bands. Also, since CW equipment is relatively easy to build, it gives an opportunity to experience the thrill of talking to people halfway around the world using a transmitter that the operator built himself.

No more excuses. Don't tell yourself you can't learn enough code in an afternoon to get a Novice or Technician license. And it's all legal! 73

Unfortunately, Mr. Love passed away earlier this year. This technique undoubtedly will generate quite a few bouquets and brickbats. Please forward your comments to 73 editorial offices rather than deluging Mr. Love's family with mail.—Ed.

73 Review by Bill Clarke WA4BLC

Yaesu FT-747GX

An affordable transceiver for Novice and Extra

Yaesu USA
17210 Edwards Road
Cerritos, CA 90701
List Price: $889.95

For several years each new transceiver brought to the market has been more complex, offered more features, and looked more formidable than its predecessors. Of course prices rose with each new entry, with top of the line radios going out of sight.

If the dollars involved are not enough of a problem, there is no modern transceiver built for the fellow looking to replace a trusty old Drake or Heathkit tube radio. No affordable, basic, recently-built radio meets the needs of arm chair ragchewing, light contesting, or enjoyable DXing...until now.

Well, Yaesu has made a stab at solving these problems by introducing a new straight forward transceiver that is full featured, excellent quality, and simple to operate. They call their new radio the FT-747GX.

First Impressions

The FT-747GX gives a lasting first impression when seen for the first time. It only weighs 7.25 pounds. The radio is very simply laid out, with only 20 controls, 15 of which are push-operated switches. The central digital display has black characters and symbols on an amber background showing frequency, mode, memory, VFO, filter selection, and more.

The FT-747GX looks so simple to operate I hooked it up and turned it on without referring to the operating manual. There were no surprises or problems encountered, and operation commenced immediately.

I should note, however, that I later read the entire manual. It is very complete, loaded with accurate information, no grammatical errors, and is easily understood. The manual also contains numerous hints to aid the operator in enjoying the radio in particular and the hobby in general.

The 747's buttons and controls all operate very smoothly. The main tuning knob has indents, and does not free-wheel like most tuning knobs. I found this a little disconcerting at first, but I quickly became used to it.

Receiver

The LCD digital display is easily read, and its amber color is easier on the eyes than some red or green LED displays seen on other radios. The frequency is displayed in large numbers, while other information (VFO in use, memory number, mode, scan, etc.) is shown in smaller characters and icons.

The SSB tuning rate is 25 Hz per click of the main tuning knob. The frequency ratio of turns is about one turn to 1.3 kHz. Fast tune is 2.5

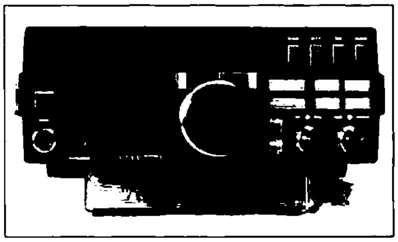


Photo A. Front of the FT-747GX.

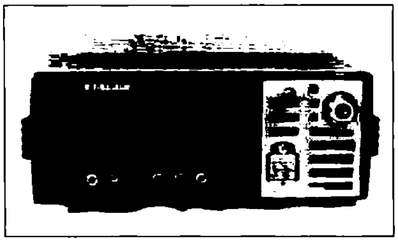


Photo B. The rear panel showing the part of the cast aluminum transmitter chassis.

kHz per click and is push switch selectable. The normal AM tuning rate is 1 kHz per click, 10 kHz at the fast rate.

The 747 has all the necessary filters built in, including a 500 Hz narrow CW filter and 6 kHz AM filter.

The memory scheme used on the 747 is very straightforward, not requiring mental gymnastics to use. Just dial the frequency and push a button. There are twenty memories.

To determine the reproduction quality of a new rig I always tune it to the local country western station on AM and listen in. The 747's audio quality was excellent. In fact, it compared very favorably with my large station speaker. The front-facing speaker has outstanding audio reproduction. There is no need for an external speaker.

The receiver is very quiet, although not as quiet as a Ten-Tec Corsair. There is no RF GAIN control, but a 20 dB attenuator is available at the push of a switch. The 747 has a noise blanker that does very well against the woodpecker and simulated ignition noise, too.

The squelch is active in all modes, and is utilized during scanning. Memory scanning is controlled from the mike.

Transmitter

Audio reports during SSB operation were all good, with most indicating excellent quality voice transmission. All contacts were made using the standard microphone that is supplied with the radio. Just remember, audio reports are not scientific and vary with the receiving operator's hearing and preferences.

Semi break-in keying is a feature of the 747. The CW note received good reports and looked good on the scope.

The FT-747GX, like most current transceivers, has two VFOs allowing it to work SSB/CW splits and split band operation. Internal programming of the CPU prevents general coverage transmitter operation.

inside The 747

Tools are not needed to get inside the 747. Just release a couple of locks, push on the designated pressure points, and the plastic case slides off the chassis. The case is completely shielded by a metal coating on the inside.

It's interesting to note that several operator changes can be made to this radio without opening it. These include side-tone volume, memory backup enable, and carrier adjustments.

The most impressive feature of the inside of the 747 is the large cast aluminum transmitter housing that provides the necessary heat sinking for the finals. It is cooled by an internal fan.

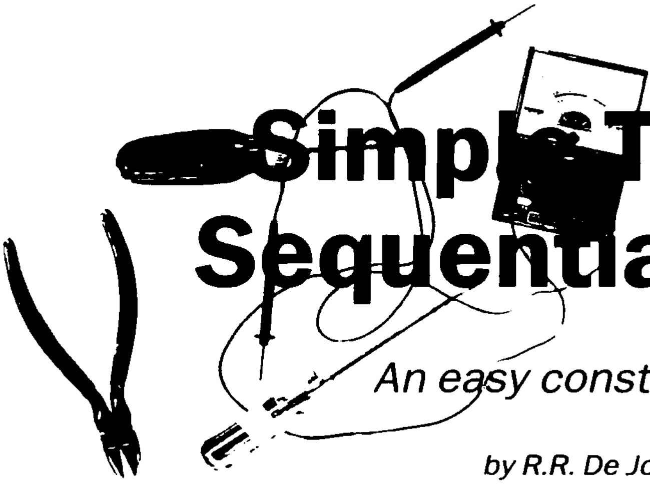
Bench Testing

To prove the manufacturer's claimed specifications, I bench tested the 747. No problems were encountered and the little radio did everything the manufacturer said it would.

The following equipment was used during the bench check:

- Leader LDC 8243 Frequency Counter
- Marconi Instruments 2022 Signal Generator
- Hewlett Packard 606 HF Signal Generator
- Hewlett Packard 651A Audio Generator
- Bird 43 Wattmeter
- Hewlett Packard 8551B/851B Spectrum Analyzer
- Cushman CE-5 Monitor
- Tektronics 475 Oscilloscope

Although the specifications check out in a laboratory environment (see sidebar), the performance of most currently available amateur transceivers exceeds the capabilities of the human ear, propagation, and atmospheric conditions. For example, high sensitivity does little good on 75 meters at 7 PM when all the kilowatts are on.



Simple Two-Tone Sequential Encoder

An easy construction project

by R.R. De Jongh WB7CPT

Could I build a simple-cheap-compact encoder? After acquiring some pager parts from a surplus buy, I managed to put together a working MINITOR™. I searched through my crystal "bank" to put the pager on a two meter simplex frequency. Since this is a tone and voice pager, it makes an excellent monitor receiver, with 0.25µV sensitivity. The tone capability also aroused the builder instinct in me. The circuit is a result of several tries, and almost as many dead ends. The 555 type IC's just do not have the frequency stability required for the job.

Component of Choice

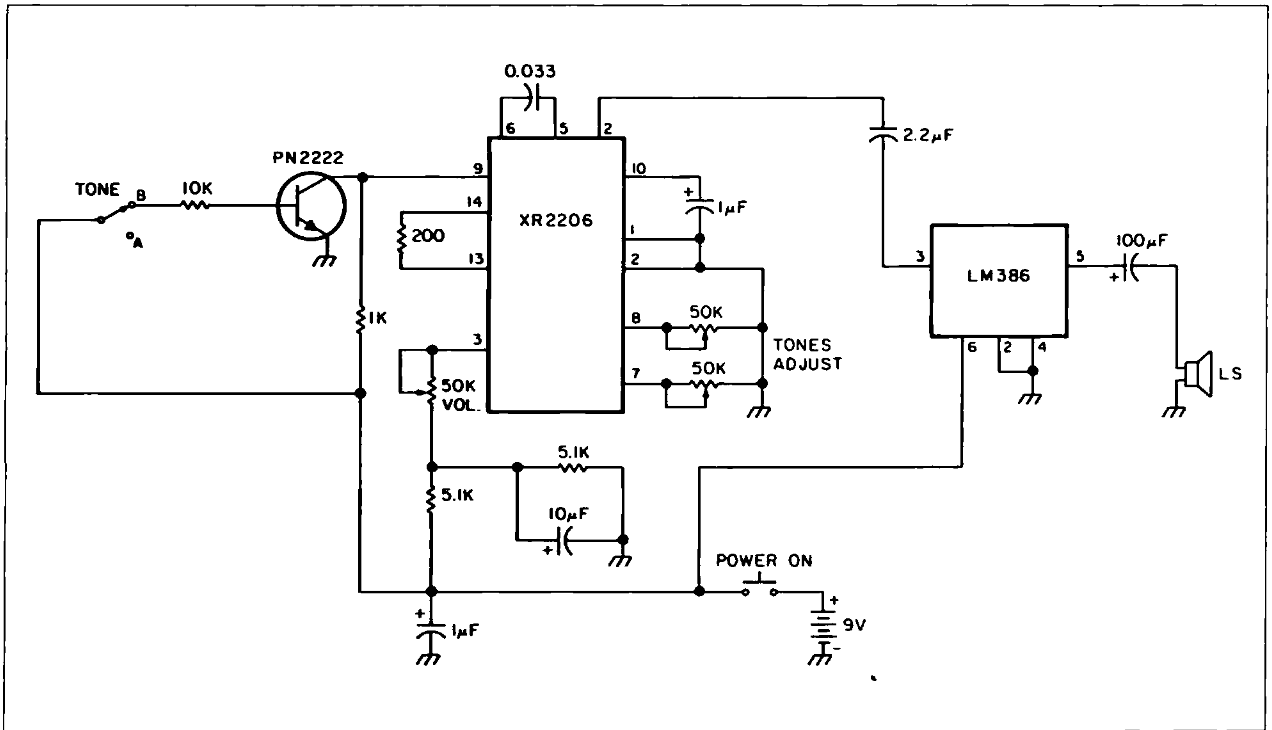
The XR2206 does the job well and also has AFSK capabilities. This circuit is quite simple. Just connect some pots to set the A and B frequencies, select a suitable range capacitor and then supply logic levels to pin 9 to select a tone. I didn't use timers to set tone times and to sequence the tones. Timers can be used by guesstimation, a second or so on the first tone and about the same for the second tone. If the experimenter decides to add in a timing circuit, perhaps a 556 CMOS type, try about a half of a second on the first and about a second or two on the second tone. There should be a gap of about 100 msec between the tones.

Easy Operation

The method I used worked well by holding the speaker right up to the mike or HT and pushing in the power switch with the A enabled. Hold it for a second and then toggle the tone switch to the B tone and hold for two seconds. Because the switch goes through a momentary open, there's a natural gap in tones.

Some pagers have a special chip added in their decoder that furnishes a "group" alert. This can be accessed by a long continous B tone, one over six or more seconds. The pager sounds the alert with a solid tone, instead of the usual beep.

Parts are not critical. Frequencies are set with the pots on pins 7 and 8, and the capacitor between pins 5 and 6. Any decent NPN transistor will do. The voltage used could be 12 or 13.8 volts as well as 9 volts. The frequency may be set with a counter across the speaker terminals. If a frequency or modulation monitor is available, set the deviation to about ± 3 kHz with the speaker right up to the mike of the transmitter. ■



The simple two-tone sequential encoder.

One interesting test I made was to key down the transmitter at full power for thirty minutes. No overheating was noted. The large chunk of aluminum does its job very well.

Operator Comments

The very slow main tuning rate is nice. I like it better than the 10 or more kHz rates found with the competition. However, fast tuning causes the unit to stop only at 2.5kHz intervals. It won't do very well for a fast check of a band. It is only meant to get the operator from one place to another quickly.

The standard microphone has UP/DOWN and FAST buttons for armchair tuning.

The 747 is ready for RTTY, Packet, and AMTOR operation. However, I think that the market this radio is directed towards will find more use for the SSB and CW capabilities. The FM unit is optional.

The mode is not selected by the rig; the operator must select it. I thought this was a drawback that should have been addressed when the radio was designed, but others may not find automatic upper or lower sideband selection a problem.

There is a built-in surge protector and antenna line fuse to protect the receiver from static discharges. Other manufacturers should take notice of this.

There is no IF shift or PBT (pass-band tuning). One or the other should have been built in.

The push switches are well labeled and easy to operate.

The switch labeled CLAR is the receiver clarifier. The terminology is out of place in ham radio. Think of it as RIT (receiver incremental tuning).

The cooling fan is very quiet.

The 747 has no notch filter, but most of those type are difficult to control. I recommend an outboard automatic notch filter such as the Datong ANF (a favorite add-on).

The 747 is CAT ready and may be controlled by a computer. It also means the Stone Mountain Engineering QSYer keypad will operate with it (another of my favorite add-ons).

Wrap-up

I feel the 747 is an excellent entry level rig for new hams. However, more importantly, the 747 fills the gap between yesterday's tube radios and the expensive and complicated rigs of today. Any operator will feel at home with it, and will not be overwhelmed by complexities. There are less controls on this little radio than on most older tube radios and operation is very straightforward. No operator intimidation here!

Would I recommend the FT-747GX? Yes! It has all the necessary features of the expensive radios to make it a very capable transceiver, yet the price is remarkably low. Don't be fooled by the low price and light-weight plastic case. The 747 is a piece of merchandise with excellent quality.

Thank you to the folks at the Electronic Equipment Bank of Vienna, Virginia, for the loan of a new Yaesu FT-747GX, and the use of their very complete test bench. 73

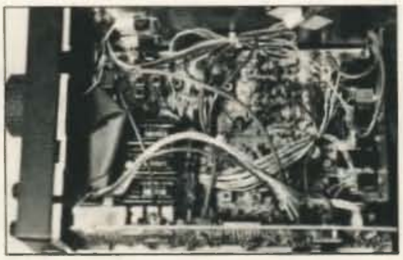


Photo C. Notice the factory installed (standard) crystal filters.

Photo D. The large box like unit is the cast aluminum transmitter chassis.

FT-747GX Specifications (as stated in the manual)

General

Frequency Coverage		
Receive:	100kHz to	29.9999 MHz
Transmit:	1.5	1.9999
	3.5	3.9999
	7.0	7.4999
	10.0	10.4999
	14.0	14.4999
	18.0	18.4999
	21.0	21.4999
	24.5	24.9999
	28.0	29.9999

Modes: SSB/CW/FM/AM (FM is optional)

Tuning Steps:	SSB & CW is 25 Hz (2.5 kHz fast) AM is 1 kHz (10 kHz fast) FM is 12.5 kHz
Frequency Stability:	± 200 Hz AM/SSB/CW (± 300 Hz FM) (0 to 40 degrees C)
Antenna Impedance:	50Ω
Power Requirements:	13.5 VDC at 19 A maximum
Dimensions:	238 x 93 x 238mm (without knobs)
Weight:	3.3kg (7.25 lbs)

Receiver

Circuitry:	Double conversion superheterodyne
IF Frequencies:	1st IF 47.055 MHz 2nd IF 8.215 MHz
Sensitivity:	SSB/CW for 10 dB S/N 500 kHz-1.5 MHz less than 0.5μV 1.5 MHz and up less than 0.25μV AM for 10 dB S/N 500 kHz-1.5 MHz less than 1μV 1.5 MHz and up less than 2μV FM for 12 dB SINAD above 28 MHz 0.7μV
Squelch Sensitivity:	500kHz-1.5 MHz is 2μV 1.5 MHz and up is 4μV
Selectivity:	SSB/CW 2.2kHz/-6 dB (5.0kHz/-60 dB) CW/Narrow 500Hz/-6dB (1.8kHz/-60 dB) AM 6kHz/-6 dB (14kHz/-60 dB) FM 8kHz/-6 dB (19kHz/-50 dB)
Image Rejection:	better than 70 dB (1.5-30 MHz)
IF Rejection:	better than 60 dB (1.5-30 MHz)
Audio Output:	4-8Ωs

Transmitter

Output Power:	SSB/CW/FM 100 W PEP AM 25W
FM Deviation:	± 2.5KHz
Spurious Radiation:	better than -50 dB
Carrier Suppression:	better than 40 dB
Unwanted Sideband Suppression:	better than 50 dB
Microphone Impedance:	500-600Ω

Novice Band Code Nets

Pass the 13 wpm test by participating in code nets

by Bill Welsh W6DDB

One of the best ways to increase code proficiency is to participate in code nets. Novice and Technician operators can quickly pass the required 13 words-per-minute General and Advanced code test by regularly participating in code nets.

Most nets serve their immediate area. Consequently, the nets listed in this article are alphabetically arranged by states, using the two letter postal service indicators. Some nets just serve one or two counties in a state. Consider operating in one of the area nets shown after the state nets, if there isn't an active net in your area.

The name of each net is followed by the abbreviated identification that is normally used on the air. As an example, the identification code for the New England Novice Net is NENN.

The net frequency is stated in kilohertz. No one owns a frequency, not even a regularly scheduled net. If the stated net frequency is in use by non-net amateurs, the net will be found a few kilohertz above or below the stated frequency.

The net operators are listed according to the following weekly system: D is daily (including weekends); Sn is Sunday; M is Monday; T is Tuesday; W is Wednesday; Th is Thursday; F is Friday; and S is Saturday.

A Sense of Time

Net start time is shown in Universal Time Coordinated (UTC). UTC is 4, 5, 6, and 7 hours ahead of Eastern, Central, Mountain, and Pacific Daylight Savings Times, respectively in the Summer. UTC is 5, 6, 7, and 8 hours ahead of Eastern, Central, Mountain, and Pacific Standard Times, respectively in the Winter. This list was prepared showing UTC net times, based on summer (daylight savings) schedules. Some nets shift their start time when their local time changes between standard and daylight savings times. If a net can not be heard at the indicated time, listen for it one hour later or earlier, (as appropriate) to compensate for a possible change in local time.

A net starting time shown as 0030 UTC (for example) would probably shift to 0130 UTC during the Winter, when standard time is being used. Remember that several states do not use the daylight savings system. Also remember that a net scheduled to start at 0300 UTC Sunday (as an example) actually starts Saturday evening, local time. Some nets suspend operations during the Summer, when member participation is minimal.

The purpose of each net is listed according to the following system: A is Area National Traffic System (NTS); E is Emergency Preparedness; L is Local NTS, O is Other; R is Regional NTS; S is Section NTS; T is Traffic Handling; and W is Weather.

The callsign of the Net Manager is listed, if it is known. Any correspondence regarding a net should be sent to the net Manager. The Novice band code nets listing is an updated list of the one printed in the December 1982 *CQ* Novice column. Every known net Manager was asked (in writing) to let us know about the changes made to the listed data. Less than one-half of the net Managers provided confirmation of correct information, plus the changed data. It would be greatly appreciated if readers would supply corrections and/or additions (in writing) to me (W6DDB), at 2814 Empire Ave., Burbank, CA 91504. Your ARRL Section Manager is an excellent source of information regarding local nets; she/he is listed on page eight of each *QST* magazine.

The February 1980 *CQ* Novice column contains a list of the three letter Q-signals, most commonly used by amateurs to make statements and to ask questions. A free copy of that list is available to anyone who requests it and supplies a self-addressed stamped envelope. The ARRL also publishes a handy reference card with Q and procedural signals. Some Q-signals apply only to net operation: Those Q-signals are listed in this article to make it easier for new amateurs to participate in net operations. These Q-signals were developed by the ARRL specifically for code net usage. They are not intended to be used during casual (non-net) on-the-air conversations, nor are they to be used in voice nets. Unlike the regular Q-signals, these code net Q-signals do not need to be followed by a question mark when a question is being asked. See the sidebar.

AL Alabama Emergency Net D (AENO)
3725 D 2330S N4DCS
CA Braille Institute QRS Net (BRL)
7105 S/Sn 19000 WB6ZPN
CA San Diego Section ARES Net (SDN)
3725 S 2330T N6LYX
CA Tuolumne County Novice Emergency Net (TNEN)
3710 Sn 2230EOT WB6SLX
(Serves Northern California)
CO Colorado-Wyoming Net (CWN)
3715 D 0130S KB0Z
CT Connecticut Slow Net (CSN)
3720 T/W/Th/F/S 0030S WB1GXZ
CT CQ Radio Club Novice Net
28125 Th 0000OT K1BCI
CT Slowfist Net
21150 T/Th 0100EOT N2CYU
DE Diamond State Slow Net (DSSN)
3735 T/Th 0030S KA3DPR
FL All Florida Slow Traffic Net (QFNS)
3714 D 0100S KA4SIH
FL Florida Medium Speed Net (FMSN)
3651 D 2130S WD4KBW
FL Platinum Coast Novice Net (PNN)
28119 W 2330T KB4GIA
(Brevard County)
GA Georgia Training Net (GTN)
3718 M/W/F 2315S W0MHG
HI Maui Emergency Net (MEN)
7120 T 0700EOT WKH6H
IA Iowa Code Net (ICN)
3705 T/Th/S 0100S NO0J
IL Illinois Training Net (ITN)
3705 D 0100ST WB8RFB

IN Indiana Code Net (ICN)
3705 D 2315S KW9D
KS Kansas Slow Speed Traffic Net (QKSSS)
3735 T/Th/S 0030S W0MYM
KY Kentucky Novice Training Net (KNTN)
3727 D 0000S KB4OZ
LA Louisiana Slow Net (LSN)
3703 M/T/W/Th/F 0030S WD5CWK
MA Eastern Massachusetts/Rhode Island Slow Net (EMRISS)
3715 D 0130/2100 SKA1EXJ
MD Maryland Slow Net (MSN)
3717 D 0030S KC3Y
MD Maryland Training Net (MTN)
3735 M/T/W/Th/F 0030S K3ORW
MI Kalamazoo Civil Defense CW Training Net
28120 Th 0130T K8OOB
MI Michigan Novice Net (MNN)
3722 D 0100/2230 SKA8NCR
MN Minnesota Slow Speed Net (MSSN)
3710 D 2300S KA0SBY
MN Paul Bunyan Wireless Association Net
28133 M 0300L KC0YG
MO Chariton Valley Emergency Net (CVEN)
3712 T/Th/Su 2330L W0OTF
MO Missouri Traffic and Training Net (MTTN)
3730 M/T/W/Th/F/S 2330 SKA0SUN
MS Mississippi Slow CW Net (MSN)
3733 M/T/W/Th/F 0000S KD5TY
NC Carolinas Slow Net (CSN)
3715 D 2300S AA4MP
ND North Dakota Slow Net (NDSN)
7145 S 2300T KO0L
NE Nebraska Novice Net (NNN)
3737/Winter D 0200S WD0BOX
7137/Summer
NJ New Jersey Slow Net (NJSN)
3735 D 2330S WB2PKG
NJ Slowfist Net
21150 T/Th 0100EOT N2CYU
NY Mohawk Valley Training Net (MVTN)
21150 W/F 0000OT KA2OQB
NY New York Training Net
3720 D 0130O KA2DQA
NY Slowfist Net
21150 T/Th 0100EOT N2CYU
OH Ohio Novice Net (ONN)
3708 D 2330T NM8I
OH Omik Slow Code Net (OSCN)
21110 Th 0200 WD8KAV
OH Triple States High Speed Net (TSRAC)
28480 Th 0130L KA8KOS
OH Triple States Intermediate CW Net (TSRAC)
28480 Th 0100L KA8KOS
OH Triple States Slow Net (TSRAC)
28480 Th 0030L KA8KOS
OK Oklahoma Liaison Net (OLZ)
3705 D 0030S W5UYH
PA Keystone Slow Speed Net
3730 M/T/W/Th/F 2330OS KA3NQA
PA Lehigh Valley Net (LVN)
3740 S 2130S
PA Triple States High Speed Net (TSRAC)
28480 Th 0130L KA8KOS
PA Triple States Intermediate CW Net (TSRAC)
28480 Th 0100L KA8KOS
PA Triple States Slow Net (TSRAC)
28480 Th 0030L KA8KOS
RI Eastern Massachusetts/Rhode Island Slow Net (EMRISS)
3715 D 0130S N1BHH
SC Carolinas Slow Net (CSN)
3715 D 2300S AA4MP
SD South Dakota Novice CW Net
3725 S/Sn/M/T 0100T KA0UEH
SD Walworth County Emergency Net
3740 Sn 1830ET W0YMB
TN Tennessee Slow Net (TSN)
3702 M/T/W/Th/F 0000S N4OZB
TX Crackle and Bang Instruction Net (CABIN)
3725 M/T/W/Th/F/S 0300 KB5ADE
TX Texas Slow Net (TSN)
3745 D 0100S KB5ADE
UT Utah Code Net (UCN)
3710 D 0230S NS7K
WI Wisconsin Novice Net (WNN)
3723 D 0000S N9DGL
WV Triple States High Speed Net (TSRAC)
28480 Th 0130L KA8KOS
WV Triple States Intermediate CW Net (TSRAC)
28480 Th 0100L KA8KOS
WV Triple States Slow Net (TSRAC)
28480 Th 0030L KA8KOS
WV West Virginia Novice Net (WVNN)
3730 D 2215ST WD8LDY
WY Colorado-Wyoming Net (CWN)
3715 D 0130S KB0Z

Area Nets

East and Middle U.S.A.
Early Bird Net (EBN)
3715 D 1100 T NG4J
Eastern U.S.A.
Hit and Bounce Slow Net (HBN)
7040 D 1330 T K2GWN
Gulf States and West Indies
Novice Gulf Coast HN (NGCHN)
21190 D 2300 W KA5ILR
Maritimes
Cape Breton Net (CBN)
3735 Sn 1730 S
Nationwide
Planetary Citizen Novices Net
21110 T/Th 2100 EOT WA6KFA
Nationwide
Transcontinental Novice Net (TNN)
21110 M 2300 O(QRP) WA2KSM
New England
New England Novice Net (NENN)
3720 D 1015 OT KA1KML
Northern States
Young Amateurs Net (YAN)
7135 T/F/Sn 2345 OT KA2KVZ
Northwest U.S.A. and British Columbia
West Coast Slow Speed Net (WCN)
3702 D 0300 EOT WB7RKU
West Indies
West Indies Net - Slow (WINS)
3710 D 2300 S KP4DJ

Special Q Signals for Net Use

QNA	*Answer in prearranged order.
QNB	*Act as relay between . . . and . . .
QNC	All net stations copy. I have a message for all net stations
QND	*Net is directed (controlled by net control station).
QNE	*Entire net stand by.
QNF	Net is free (not controlled).
QNG	Take over as net control station.
QNH	Your net frequency is high.
QNI	Net stations report in* I am reporting into the net. (Follow with a list of traffic or QRU.)
QNJ	Can you copy me? Can you copy . . .?
QNK	*Transmit messages for . . . to . . .
QNL	Your net frequency is low.
QNM	*You are QRMing the net. Stand by.
QNN	Net control station is . . . What station has net control?
QNO	Station is leaving the net.
QNP	Unable to copy you. Unable to copy . . .
QNQ	*Move frequency to . . . and wait for . . . to finish handling traffic. Then send him traffic for . . .
QNR	*Answer . . . and receive traffic.
QNS	Following stations are in the net.* (Follow with list.) Request list of stations in the net.
QNT	I request permission to leave the net for . . . minutes.
QNU	*Establish contact with . . . on this frequency. If successful, move to . . . and send him traffic for . . .
QNV	*Establish contact with . . . on this frequency. If successful, move to . . . and send him traffic for . . .
QNW	How do I route messages for . . .?
QNX	You are excused from the net.* Request to be excused from the net.
QNY	*Shift to another frequency (or to . . . kHz) to clear traffic with . . .
QNZ	Zero beat your signal with mine

*For use only by the Net Control Station (NCS).

73 Review *by Bryan Hastings KA1HY*

GGTE Morse Tutor

For PC owners at any code level.

GGTE
21881 Summer Circle
Huntington Beach CA 92646
Price Class: $20

How does someone learn Morse Code without a partner?

Easy Installation

Morse Tutor is the brainchild of Warren Hoffnung KF6VV. This, the Version 2.1 program, runs on any MS-DOS or PC-DOS computer, with as little as 128K of RAM. The printed instructions accompanying the program disk show in detail how to install Morse Tutor on either a hard disk or floppy. They even give a DOS batch program for a hard disk system, by which one can run the program with a single DOS command from any directory (given the proper PATH settings). They also show how to make a working copy of the program.

Since PCs and clones have different internal clock speeds, such as 4.77, 6, and 8 MHz, Morse Tutor has a routine to match the program timing with the clock speed of the code-learner's particular machine. This calibration takes several minutes to perform, and is automatically saved to disk—a proper calibration needs to be done only once for a given computer. One caveat: Don't put a write-protect tab on the working copy, since the computer writes to the disk during calibration.

Tale of Two Methods

Morse Tutor offers the user a choice between two methods of Morse code instruction—Standard and Farnsworth. The first method keeps the time elements between "dits" and "dahs," characters, and words, all in the same proportion. When the sending rate increases, for example, the time periods between "dits" and "dahs," characters, and words, all shorten proportionally.

The latter—and increasingly more accepted—method allows independent character and word speed settings. This is the default setting. This system recognizes that many CW students quickly go from adding dits and dahs together to identifying the character only by its unique sound. Curious evidence of this comes from hams who are unable to copy Standard code much slower than their present level!

With the Farnsworth method, the learner can set the character speed at the goal speed, which means he need not relearn a new sound for the same character as his copy rate picks up. Furthermore, the listener need concentrate only on shortening the spaces between characters and words.

The Characters Themselves

Morse Tutor first presents the alphabet, and then the numbers 1–9, 0, punctuation, and prowords (telegraphy-specific codes), all in 11 groups of four characters. The first group presents "A" ("di-dah"), and "N" ("da-dit"). These simple dah-and-dit juxtapositions clarifies their different sounds to the beginner. "S" and "O" ("di-di-dit" and "da-da-dah") are sent in the same group. The next six groups presents the rest of the alphabet in progressively more complex combinations of dits and dahs, always taking care to put those with similar (i.e. easily confusable) patterns in the same group, again to clarify them to the student. The learner can select, however, the group to which he wants to listen.

Morse Tutor presents each group in three parts. The first segment sends each of the four lesson characters five times, while displaying the ⅓-screen size character. The second sends this group's characters randomly. The final segment sends random words composed of the characters. Segment Three in Lessons Two–Nine sends words composed of characters from the first group up to, and including, the present. Like the groups, the student is completely free to choose any segment, regardless of order.

There is a minor drawback in Segment Two. The characters are sent in long strings, making it difficult for the copier to compare his copy with the screen display. Organization of these strings into short groups, say, five characters long, would ease copy verification.

Also For Upgraders

Morse Tutor shines in Lesson 12. Here, a random QSO (conversation) is sent, closely patterned off the amateur radio exam QSO. It lasts for ten minutes, and can be cancelled any time before then. The student can view the text on the screen as it is sent, or choose to see it only after the QSO finishes (or is terminated). At higher speeds it will even send a response QSO!

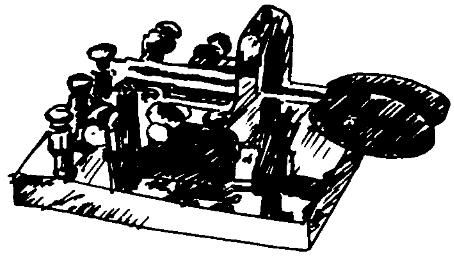
Conclusions

GGTE Morse Tutor is a *very* well thought-out program. PC and clone neophytes can easily use it. One could rely totally on the program after initialization, but I suggest also reading the manual—it's sprinkled with interesting code-learning tips. The user is free to learn CW by the Standard or Farnsworth method, set any speed up to 100 wpm, set any audible sidetone pitch, and go through the lesson groups—and segments within the groups—in any order. Rank beginners, however, need not be frightened by too many choices. Tone pitch, character rate, and word rate all have sensible default settings—just skip through that menu and follow the lessons.

Best of all, Morse Tutor replaces your Elmer in two critical areas—it chooses one of billions of possible random QSO combinations to send, making them impossible to predict, and it lets you immediately check copy accuracy.

Don't be tempted here by the psychology that rates the worth of a product by its price tag. Morse Tutor is, quite simply, a superb value.

How to Improve Your Code Speed



Yes, you can!

by Edward F. Rice W9NGP

Not being a high speed CW operator, I still love the mode and work mostly CW on the air. Before I went for the 13 wpm exam, it took a couple of *years* of daily CW practice, and then I barely made it.

After several decades of struggling to improve my code speed, I have discovered some methods that worked well for me. I will pass those methods along in this article.

• 1. Develop a vocabulary of words that can be recognize without copying the letters.

Many words have a unique sound when sent by CW. Try sending these words briskly and hear how they sound:

cycle little remember
between field needed
beginning antenna highest

There are hundreds of words that are easily recognized by their rhythm without even copying the letters.

If using a typewriter, words are often typed by initiating a sequence of finger movements controlled by a program stored in the subconscious. This causes the brain not to think about the individual letters. It's the same with copying CW; it increases the speed because of the less work the brain has to do. The more words that can be recognized, the faster and easier CW becomes. By sending words into my tape recorder and playing them back, I increased my vocabulary speed. I allowed a few days for the words to fade from my conscious memory, and I tried sending the words a little faster than my normal receiving speed. I kept the spacing between words the same as in a regular sentence. This required me to listen to the next word while trying to spell out the hard copy for the word I had just recognized. Copying behind like this teaches one not to anticipate words from the first few letters, and to watch for endings like "ing," "ly," and "ed," which change the meaning.

• 2. Pay close attention to what is coming next.

Of course, every word can not be recognized, so the letters have to be copied at times. One of the hardest obstacles I had to overcome was my insistence on copying every letter. If I missed one letter, I would get stuck thinking about it and miss the whole word, sometimes even the next two or three words.

Copying Morse code is like reading somebody's handwriting. Often letters are scribbled illegibly, but the word can still be made out. When a letter of code is missed, due to interference, poor sending, or a slight lapse of concentration, focus on what letter is coming next. The word can usually be made out after learning the rest of the letters. If a letter is missed, forget it. Never look back, not even for an instant.

To forget about a character sounds easy, but it isn't. Amateurs hate to let go of anything when they perceive that it may be recovered. Copying CW is *not* like a ball player who bobbles a catch and reaches for it again successfully. Once a letter of CW is lost, it is gone forever. And if it is chased after, more letters will be lost. Chasing after lost letters is one of the worst habits an amateur can have. Never look back!

• 3. Use a tape recorder to review the copy sent.

This step is an easy one, because it doesn't require any mental training. Simply record the practice material as it is sent, then play it back and follow the words on the copy. To note the places where there is a stumble in the copy, helps to improve the receiving ability. Be aware of certain weaknesses that cause a combination to become repeatedly missed. Some types of combinations frequently missed are abbreviations, punctuation, numbers, or words with "ie" and "sh." One code that always catches me is the letter R, used for a decimal point in a number.

Using the tape recorder is also a very good way to improve sending. Send text into the machine for 10 minutes and then, a few days later, replay the CW and try to copy it. Many irregularities will be found that make sending more difficult to copy. Morse code that sounds nearly perfect when sending may be loaded with flaws that are only noticed when copying.

• 4. Without making a hard copy, practice copying code mentally.

With eyes closed, just listen. Some amateurs can visualize the letters moving past their closed eyes like watching a computer readout. Others, like me, hear the words as if they were spoken by the sender.

This takes a while to learn and it's a little difficult to get started. Code can be easily read if it's been sent slightly faster than the normal slow sending. It's excellent practice and makes rag-chewing a pleasure when CW is mastered. Don't be dependent on pencil and paper.

• 5. Work with a friend whenever possible.

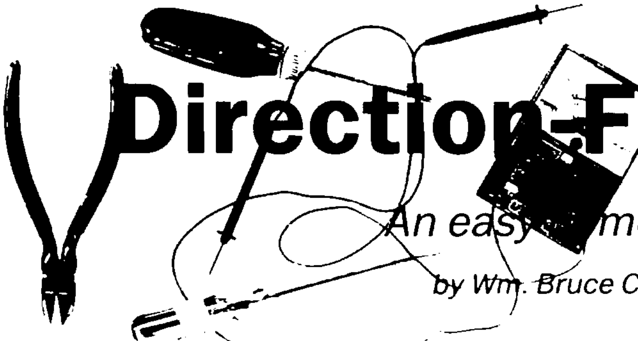
One reason why this is so important, is that learning to copy Morse code is a very frustrating endeavor. We all get discouraged and, seeing no progress, look for other activities which offer more immediate benefits, easier. But, fortunately, when amateurs work together, they do not become discouraged with code practice at the same time. So one amateur is able to help the other to keep practicing until his spirits are renewed.

Psychologists assure us that the periods of boredom and frustration are always temporary. The interest and enthusiasm will return. When embarking on any regimen of training, whether physical or mental, progress seems to come in spurts. Before each noticeable immprovement, there are "plateaus."Psychologists and teachers use plateau to describe a person who is trying to learn, but nothing seems to be happening despite continued practice. This is when a friend is needed.

In learning to copy Morse code, the plateaus are clearly observed at certain speed levels. For most amateurs, the first one is around 5 wpm, when continuous practice yields no increase in speed. This lasts for a few weeks, then suddenly the speed jumps to 8 or 10 wpm. Other plateaus occur around 15, 25, and 35 wpm. It is best to be beyond the 15 wpm plateau when taking the 13 wpm test to overcome the stress of a test situation. When working with another amateur, don't spend practice time sending to each other. This wastes too much time, unless a CW keyboard or computer is available for perfect code and constant speed. Learning to send code is like learning to play a musical instrument. Nobody wants to listen to someone practicing.

Good use for practice time is achieved when both amateurs copy from a receiver or a machine and compare the copy later. Don't work more than one-half hour at a time. Two one-half hour sessions with a break in between is a good daily schedule.

In these paragraphs, I have tried to avoid making it seem easy. Learning Morse code is very hard and many who have not succeeded will say that it isn't worth the effort required. But no one who has mastered even a moderate code speed, would give up the sense of pride and pleasure that comes from CW contacts on the air. There is an empathy, an understanding between operators who each appreciate the effort the other has made to develop the skill required for them to communicate. For me this is the best part of amateur radio. ■



Direction-Finding Loop

An easy home-brew project

by Wm. Bruce Cameron WA4UZM

For tracking spurious signals to their source, or for hidden transmitter hunts, the DF Loop is a useful gadget. The design is built around a bandaid box and uses BNC connectors to change the loop length to work on different frequencies. If the operator is going to use it on only one band, and flexibility is not needed, the builder can solder the braid directly to the can. However, once other hams are aware of the DF Loop, they will wish to borrow it, so plan on building a flexible one in advance.

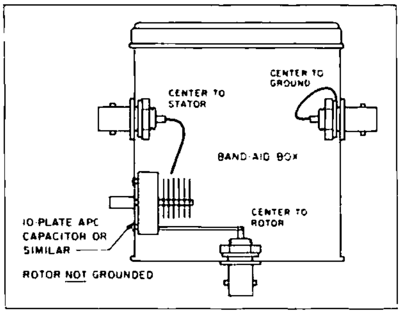


Figure 1. The bandaid tuning box.

For 146 MHz, a reasonable length is 34". The tuning capacitor will resonate anything that is close, so the length is not critical. Note that the coax braid is separated at the top for half an inch or so.

I built this one on a four-foot piece of screen stock with an 8½" tee at the top to help hold the RG58. With RG8, a tee is not needed since it is stiff enough to hold a roughly circular shape unreinforced.

In fancier models I have used broomsticks and made a window mount to support them. The operator can be as crude and dirty or as neat and fancy as he wishes, but the effect is the same.

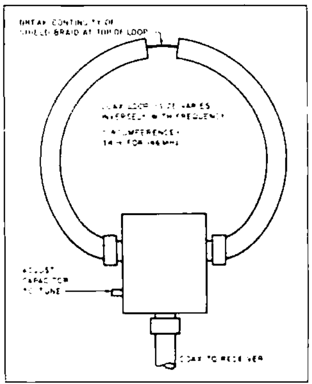
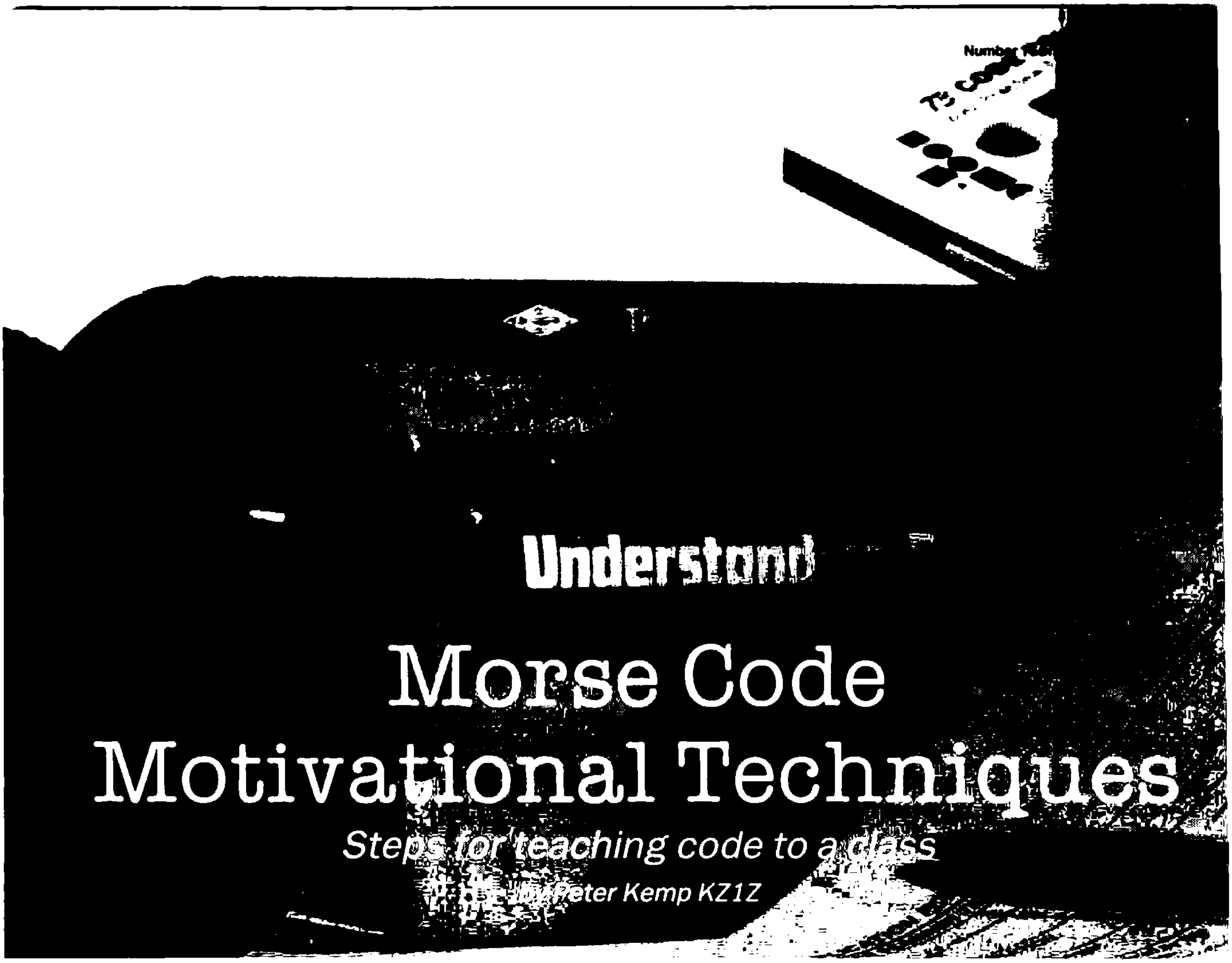


Figure 2. The DF loop.

In use, the operator must first get close enough to hear a strong signal with the regular antenna. The loop should then be installed with maximum acceptance being crosswise. When the operator gets close enough to overload his receiver, he should turn edgewise and look for a null. If hunting a broad or wandering signal, it may be better off to use a super regenerative receiver. Modern ham receivers could be too narrow and they may become aggravating with constant retuning. 73



Morse Code Motivational Techniques

Steps for teaching code to a class

by Peter Kemp KZ1Z

While there are many valid methods for teaching the Morse code, one element is consistent with all—*motivation*. The ability of the instructor to maintain a high level of student participation and interest is essential to the student's future success in mastering Morse code.

Over the years I have put together a series of little tricks to make learning the code a little more fun. The first step is to access the academic and maturity levels of the students participating. Not all techniques will be sucessful at all levels, so modifications should be made as appropriate.

Get the students actively involved immediately. Once the code letters are practiced, let the students make up words or short sentences reflective of the code groups covered. The students will listen more intently, since they're waiting for the instructor to use *their* words.

Content of practice drills. Peer pressure is a valuable tool with students of school age, especially if it is used in a positive manner. By sending sentences to congratulate sports teams of their victories; individuals on their efforts and accomplishments; as well as reinforcing positive character statements; will be most effective.

Mix-up. Once all characters are taught, send interesting mixed groups. Items such as Star Wars' R2D2 and C3PO, and rock groups such as U2 are usually well received.

The fish bowl. Let the students compose words or select the characters by placing all of their suggestions in a container. When it is time for the instructor or student to send, let them select the words, phrases, or sentences previously submitted.

Contest time. Students like competion and once they master the fine art of Morse code, have a contest too see who is the best. This technique will only be effective if it is in a properly controlled environment. Using popular game shows, teams of individuals may compete in modified versions of Password™, Jeopardy™, College Bowl, or other high interest games.

Do this. The students have always liked this technique. Send a short sentence requesting the students to perform some type of physical act, such as "blink your left eye." Then all the instructor has to do is look around the room to see who copied the command. Begin with large motor activities, such as "stand up," then refine the act. Even seemingly silly things, such as "wiggle your ears" can be done without too much of an uproar. Once I asked the class to scratch their heads. One student didn't copy the instructions properly, and was a bit puzzled. He looked around and saw everyone else scratching, he responded by moving his chair away from his classmates. An alternative would be to play Simon Says, using SS to save time when issuing commands.

Did you hear the one about... Set up the class for a punchline. Begin a story or joke verbally and send the punchline in Morse code. This technique will also work with positive gossip, such as an upcoming dance or party.

Maximize time available. Give the students as much opportunity to send as possible. By so doing, they become more involved in the learning activity, since it requires the use of more learning modes, such as sight, sound, and touch.

Be creative. Give the students an opportunity to communicate via the Morse code using alternative means. Who says the only way to receive code is via a properly adjusted Code Practice Oscillator? Ever try sending code via a flashlight, blinking eyes, a bullhorn, trumpet, pen clicks, or pencil taps?

Code only day. Students must communicate with each other via Morse code, *no talking* allowed. Total immersion into the subject fosters a variety of creative abbreviations.

Briefly Speaking: Hornblower 2

Not just another DTMF decoder

by W. Max Adams W5PFG

The Reason

Hornblower does more than just blow horns. Originally, a DTMF coded system was conceived to allow remote control of household features, such as lighting, air conditioning and hot water heating. I wanted this because I was a field service representative who travelled with his wife away from home for up to eleven months at a time! There was the big worry that the house would be broken in to during our long absences!

"OM, why not build a Hornblower?" To my wife, OM means Old Monkey.

So off I set to do just that. Read on to find out about it.

The Original Hornblower

Hornblower One (HB-1) used a 12-volt SSI201 IC interfaced to Ma Bell wires. When called, the home phone would ring one time, then become silent. HB-1 needed to recieve some DTMF within five seconds before it hung up.

So, while at the airport on the way home, I drop a quarter and phone home, plus some HB-1 DTMF codes. Code A6024A turns a nice 25-watt/0.2μV, 200-foot DB-24 repeater on. Code B6025B turns it off. Code 6025 turns bedroom, bathroom and front porch lights on and rings the door bell once every 60-seconds. Code 6027 turns air cooling conditioning on, or, Code 6029 turns air warming conditioning on. Code 2406 resets it all to off. Later, within repeater range, several "fun-and-game" DTMF codes encourage unwanted intruders to not be home when CB (my wife) and I arrive.

Hornblower's range of uses is limited only by the user's imagination! HB-1 was massaged into Hornblower Two—a more advanced DTMF controller.

Hornblower Two

Hornblower Two consists of three basic modules: a DTMF/1-16 decoder, a Window Gate (WG), and a Coded Relay Latch (CRL).

DTMF codes are sequentially selected by pressing keypad switches (Figure 2), or selecting automatic programmable memory circuits. A four-digit DTMF code sequence uses the first three digits as device identification, and the fourth digit for the ON function. An OFF function requires the same three digits for device identification, and a different fourth digit to reset the associated device. Star (*) and pound (#) DTMF signals are not used for Hornblower codes. These are reserved for "open" autopatch use. Four-digit DTMF sequences provide 11,340 usable control codes. Two typical codes are:

1234 Device ON, 1235 Device OFF

Repeating digits, such as 1123, 1223, 1222, etc., will work, but the repeated digit "falls through," reducing dialing security by a digit or more.

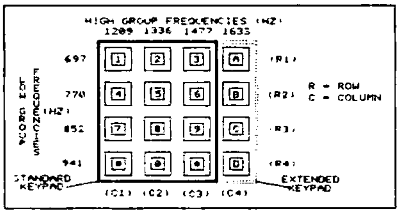


Figure 2. 4" x 4" Keypad DTMF Frequencies.

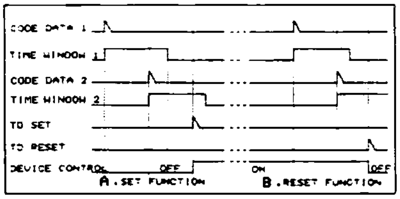


Figure 3. Hornblower Signal Flow Diagram.

Hornblower's DTMF/1-16 decoder module uses three integrated circuits: an SSI202 DTMF decoder, a CD4001 Strobe/Enable circuit and a CD4514 one-of-sixteen demultiplexer. See Figures 4 and 12. Radio receivers, telephone lines, and photo-optical systems can supply the audio frequency signals containing DTMF information. DTMF receiver, U101, uses a 3.57 MHz color-burst crystal to provide a stable reference "clock signal" for 101's decoding and logic timing circuits. U101 processes the incoming information, and, when DTMF signals are detected, logic (hexadecimal format) signals are applied to a four-line output bus circuit. Approximately 7 μs after data representing the received DTMF is present on U101's output bus, a logic high (1) signal appears as a DATA VALID (DV) output. DV triggers a one-shot circuit, which provides Enable (EN) and Strobe (STRB) logic signals to a one-of-sixteen demultiplexer. A sixteen line Tone Data (TD) bus includes logic high pulse representation of received DTMF 1 through 0, A, B, C, D, * and # data.

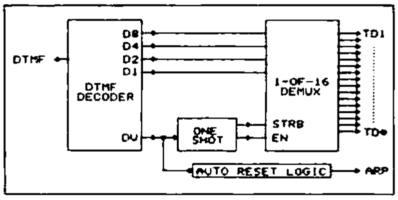


Figure 4. DTMF/1-16 Module Block Diagram

Hornblower uses two-input passive AND gates, which provide ENABLE (EN) and TONE DATA (TD) input to WG and CRL modules. (Active, two-input AND gate ICs could be used, however, because of single sided circuit board layout and "learning curve" considerations, I decided to use the "oldie but goodie" diode/resistor "wired AND" gate). The AND gate and NOR gate schematic symbols and truth tables, shown in Figures 5A and 5B, help clarify Hornblower's operation.

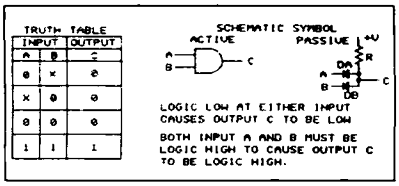


Figure 5A. Two-Input AND Gate Schematic Symbols and Truth Table.

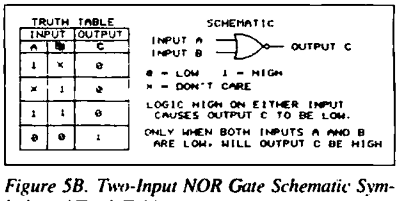


Figure 5B. Two-Input NOR Gate Schematic Symbols and Truth Table.

Low current, CMOS two-input NOR gates are used as conventional one-shot Window Gate (WG) and flip-flip-flop Coded Relay Latch (CRL) circuits.

Each WG includes a passive two-input AND gate and a 1-shot timing circuit. See Figure 6B. According to the truth table shown in Figure 5A, AND gate input A and input B must be logic high (1) for output C to be logic high. One input of a passive AND gate can be left disconnected, or "floating" to a logic high condition, which enables logic high activity on the remaining input. Likewise, one input of any AND gate may be either switched manually or logic

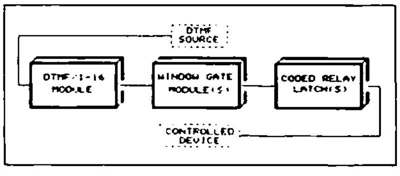


Figure 1. Hornblower Functional Block Diagram.

controlled to enable logic activity on the other input. One AND gate input of Hornblower's first window gate is left floating, which enables the remaining input to accept the first Tone Data pulse of the DTMF code sequence.

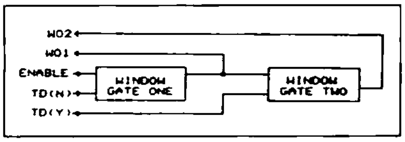


Figure 6A. Dual Window Gate Block Diagram.

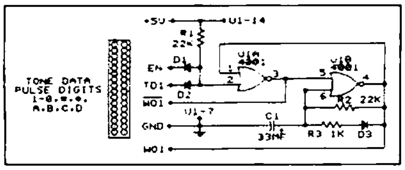


Figure 6B. Typical Dual Window Gate Module Schematic Diagram.

A logic high pulse applied to U1-2 (Figure 6B) causes a logic low (0) to U1-5. Previously U1-4, being logic low, discharged capacitor C1, causing U1-6 to be held logic low. According to the truth table shown in Figure 5B, logic high to U1-5, when U1-6 is logic low, causes U1-4 and U1-2 to become logic high. A logic high to U1-2 causes the circuit to "latch-up" and allows U1-4 to provide C1 a charge voltage source at a rate controlled by R2. C1 continues charging until U1B's logic high threshold is reached; U1-4 (and U1-2) then change to logic low, restoring (resetting) WG to its original condition.

Capacitor C1 discharges through resistor R2, when U1-4 is logic low, at approximately the same rate used during its charging interval. Should quicker circuit recovery time be desired, R2 may be parallel connected with resistor R3 and diode D3. This reduces circuit resistance from that of R2 to approximately that of R3, thereby discharging C1 at a faster rate.

Window Output 1 (WO1) becomes logic high, during C1's charging interval, enabling the circuit to accept the next TD pulse input. A TD pulse input to the second window gate, after completion of the enabling WO period, will not initiate the second WG. Likewise, when the correct TD pulse arrives during the first WG enabling interval, the second WG becomes active, providing an enable to the next circuit.

The user can connect several WGs "in series." Each WG adds an additional code digit, thereby increasing dialing security and total number of usable codes. The last WG enables a Coded Relay Latch circuit (CRL), shown in Figure 7A.

Two passive AND gates and one 2-input NOR gate are used for each Coded Relay Latch (CRL) circuit. See Figure 7B. A single WG logic high (WO) output enables (EN) each AND gate.

A Tone Data Set (TDS) pulse applied to D1 causes U1C-9 (Figure 7B) to become momentarily high. According to the NOR Gate logic table (Figure 5B), when U1C-8 is low, U1C-10, and U1D-13, through resistor R6, becomes low when the TDS pulse occurs. U1D-12 is held logic low (via D4's circuit) due to no TDR pulse at this time and therefore U1D's output (U1D-11) and U1C-8, through resistor R7, becomes high, "flipping" the latch circuit ON.

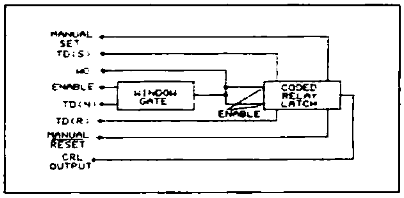


Figure 7A. WG/CRL Block Diagram.

The base of transistor Q1 is forward-biased when U1D-11 becomes high, causing its collector-to-emitter (C-E) circuit to saturate. Low (saturated) resistance of Q1's C-E causes relay K1 to energize, thereby switching K1's common (C) contact from Normally Closed (NC) to Normally Open (NO).

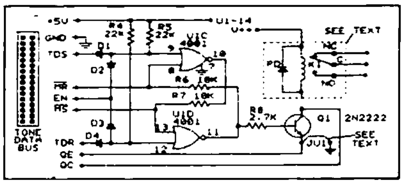


Figure 7B. CRL Schematic Diagram.

Q1's collector and emitter connections (with jumper JU1 removed) are wired to card edge connections QC and QE, respectively. This allows Q1 to be connected to a larger, high current transistor in what is known as a Darlington Pair. See Figure 7C. The use of a higher current switching transistor permits control of larger relays, which require greater mechanical power to operate their contacts.

PD becomes forward-biased when Q1 (and/or its associated high power external transistor) is switched OFF, thereby shunting a high voltage spike created by K1's collapsing magnetic field. Protective diode PD, when used with external relays, should be located at (directly across) the external relay's coil.

System wiring (Figure 8) and all other components used for my prototype Hornblower Two are mounted in a 2 x 3 x 5-½ inch aluminum enclosure. 10–15 VDC power operates K501 and IC501, a 5 VDC regulator, which provides power to a DTMF/1-16

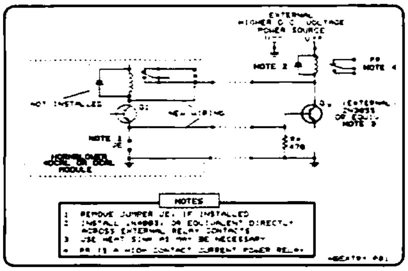


Figure 7C. Power Relay Wiring Diagram.

decoder module and a 4-digit Coded Relay Latch module. The internal (or external) speaker is connected directly to the DTMF source, when power switch S501 is OFF. R502, a ½-watt resistor, serves as an audio source dummy load when Hornblower (HB) operation is selected and the unit is inactive. Relay K501 is energized by a single transistor (Q1) located on the CRL module. One section of K501 switches the audio source, from R502, to the speaker circuit, when the unit is active, allowing source audio monitoring AUTO RESET is used to prevent Hornblower resetting and continuous "horn blowing." CRL Manual Set (MS) and Manual Reset (MR) panel switches provide local control of each device, without use of DTMF codes.

Additional control functions can be added to one DTMF/1-16 decoder module and each WG output may be connected to several WG and/or CRL modules. The first WG enable (EN) input is left "floating" (logic HIGH) for normal dialing code operation, or may be switched to ground, thereby disabling all associated (subsequent) functions.

Hornblower code coordination should be developed for each geographical area. Dialing security is enhanced by use of "dummy" digits, or extra digits provided by additional window gates. 11,340 unique four-digit codes are available—adequate for most areas. I suggest the following system for assigning four digit codes:

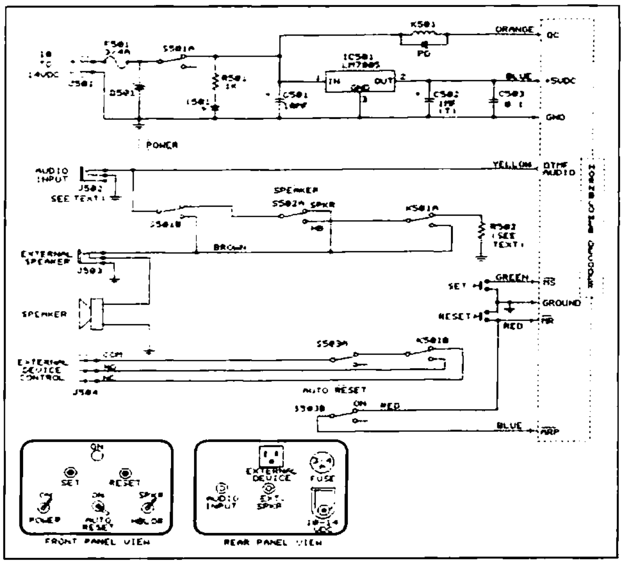


Figure 8. Hornblower system wiring diagram.

Breakdown of Hornblower Code 1234:

First digit = Number One of ten geographical areas.

Second digit = Second of nine groups in area 1000.

Third digit = Third of nine individuals in group 2, area 1000.

Fourth digit = Fourth of nine functions, 3rd individual in group 2, area 1000.

Figure 9 shows a Hornblower system with an added WG and CRL. The code example above is expanded by the use of DTMF A, B, C or D (TD4) and one additional 1 through 0 DTMF digit. In this configuration, for example, 123A4 sets CRL 2 On, and 123A5 sets CRL 2 OFF.

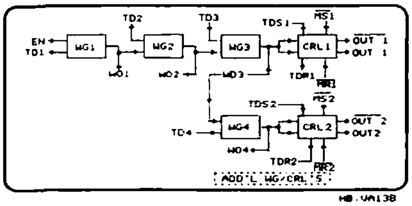


Figure 9. Two-function Hornblower Block Diagram.

DC power required for Hornblower operation is dependent on the total number of Hornblower modules and relays used in an individual system. See Table 1.

DC Supply Voltage (VDC)	9.0	12.0	13.6
DTMF/1-16			
Decoder Module	19.0	22.0	23.6 mA
4-Digit Coded Relay Latch	0.1	0.1	0.1 mA
Relay (12 VDC, 250Ω Coil)	27.0	43.6	49.2 mA

Table 1. Hornblower Power Requirements.

Hornblower module construction is not critical. Since the highest frequency used is 1633 Hz (except for the 3.57 MHz colorburst crystal), component part layout using wire-wrap, perf-board or etched printed wiring is OK. Resistor and capacitor values may be altered to suit individual requirements. For example, longer RC time constants provide longer window enabling, which allows slower dialing intervals, without effecting higher speed, automatic (memory) dialing. Short time constants can be used to allow automatic dialing and restrict manual dialing. Restriction of manual dialing increases the difficulty of "Keypad Charley's" invasion of critical control systems.

Since the DTMF/1-16 decoder module is common to all other modules, complete this first. Don't apply audio frequency signals or receiver noise to the decoder module before DC power to keep U101 from harm.

Two points before continuing to the testing procedure. The following was omitted from the printed circuit board layout. TDA, TDB, TDC, TDS, and TDR are short flexible connections to TDP for code sequence selection. I used right-angle "berg" pins connected to color-coded #30 wire-wrap wire. Use heat shrink tubing on each pin to isolate adjacent connections.

Refer to the 4D CRL foil layout in Figure 10. The builder must connect a wire from the collector of Q1 to the blank space of the card-edge connector (after the fourth card edge trace from the left). This allows connection of external relays, LEDs, etc.

System Test

Make sure to test each module individually. Hand-draw a diagram using only the completed module as a reference, and then compare it to the original schematic to insure correctness of circuit wiring and component installation. Make sure that DC voltage cir- cuits are properly isolated and of correct polarity.

Wear a grounded wrist strap when handling CMOS chips to avoid damaging their delicate circuitry from static discharge.

Pin Number	DTMF/1-16	DCRL	4DCRL	4WG
1	+5 VDC	+5 VDC	+5 VDC	+5 VDC
2	Ground	Ground	Ground	Ground
3	Audio Input	Not Used	RY Common	Not Used
4	ARP	Not Used	RY NO/NC	Not Used
5	Not Used	Not Used	Not Used	Not Used
6	Not Used	Not Used	WOA	Not Used
7	Not Used	QB	WOB	WOA
8	Not Used	MSB	ENB	ENA
9	Not Used	MRB	ENA	ENB
10	Not Used	ENB	WOC	WOB
11	Not Used	ENA	ENC	ENC
12	Not Used	QA	LEN	END
13	Not Used	MSA	MS	WOC
14	Not Used	MRA	MR	WOD
15	TD1	TD1	TD1	TD1
16	TD2	TD2	TD2	TD2
17	TD3	TD3	TD3	TD3
18	TD4	TD4	TD4	TD4
19	TD5	TD5	TD5	TD5
20	TD6	TD6	TD6	TD6
21	TD7	TD7	TD7	TD7
22	TD8	TD8	TD8	TD8
23	TD9	TD9	TD9	TD9
24	TD0	TD0	TD0	TD0
25	TDA	TDA	TDA	TDA
26	TDB	TDB	TDB	TDB
27	TDC	TDC	TDC	TDC
28	TDD	TDD	TDD	TDD
29	TD*	TD*	TD*	TD*
30	TD#	TD#	TD#	TD#

Coding for the above table:
DCRL - Dual Coded Relay Latch
4DCRL - 4-digit Coded Relay Latch
RY - Relay
NO/NC - Normally Open/Normally Closed
WO(A-D), - Window Open (A-D)
MS(A), (B) - Manual Set (A), (B)
TD - Tone Data
Q (A), (B) - Transistor (A), (B)
EN(A-D) - Enable (A-D)

Table 2. Hornblower Board Pin-Out.

Testing of a Hornblower system requires a DTMF source and a VOM. I used an IC-2AT with a dummy RF load and a short patch cord from the earphone jack to Hornblower. The user can hear the keypad DTMF as each digit is dialed, making it easier to observe voltmeter indications. Refer to the block diagram of the system (Figure 1) for clarification.

Again, don't apply audio frequency signals or receiver noise to the decoder module before DC power so as not to damage U101.

Install a jumper at AR1, AR2, or AR1 and AR2 to select the desired AUTO-RESET timing interval.

Connect the test DTMF source and apply power to the Hornblower system, then apply power to the test source. Observe the voltmeter indications listed below.

Voltmeter indications on the DTMF Decoder (DTMF/1-16) module:

1. +5 VDC on U101 pins 2, 3, 5, and 8.
2. +5 VDC on U102 pins 14 and 11.
3. +5 VDC on U103 pins 24 and 23.
4. +5 VDC on U101 pin 14, when transmitter is keyed ON and any DTMF key is pressed.
5. +5 VDC on U103 pins 2, 3, 21, and 22 when transmitter is keyed and an associated DTMF key is pressed.
6. Observe momentary positive voltage indication on each Tone Data output from U103, when transmitter is keyed and an associated DTMF key is pressed.
7. Connect voltmeter to U102 pin 10. Observe time of day (minutes and seconds) when transmitter is keyed and any DTMF key is pressed and measure duration of auto-reset voltage.
8. If it's hard to see the the tone data pulses from the DTMF/1-16 Module, *temporarily* connect a 10μF capacitor across C-104. Observe capacitor polarity—positive terminal to U102B, pin six. This causes the Tone Data pulses (TD1 to TD#) to dwell longer, allowing easier measurement with VOMs and DVOMs.

4DCRL Module Test

Use these procedures to test the four-digit Coded Relay Latch:

1a. Install 4DCRL module on suitable motherboard, interfaced to DTMF/1-16 module. See Figure 11. The configuration in Figure 11 will turn on a speaker (code 1234), reset (1235), send an all call for geographic area 1 (1A), and send all group 2 in geographic area 1 (12B).

1b. Place HB/SPKR switch in HB position.

1c. Place AUTO-RESET switch OFF.

Connect the test DTMF source and apply power to the Hornblower system. Then, apply power to the test source (see Figure 11). Observe the following voltmeter indications:

1. +5 VDC on U1 pins 3, 11 and 14.
2. Operate Manual Reset (MR) push switch momentarily.
3. +5 VDC on U2 pins 3, 9, 11 and 14.
4. Power supply unregulated (DC source) voltage on Q1 collector.
5. Zero volts on Q1 Emitter.
6. Zero volts on U1 pins 4 and 10.
7. Zero volts on U2 pins 4, 8 and 13.
8. Connect voltmeter to U1 pin 4. Observe time of day (minutes and seconds), when transmitter is keyed and the DTMF key associated with this WG's TD selection is pressed. Measure the duration of window gate output (WOA) +5VDC voltage.

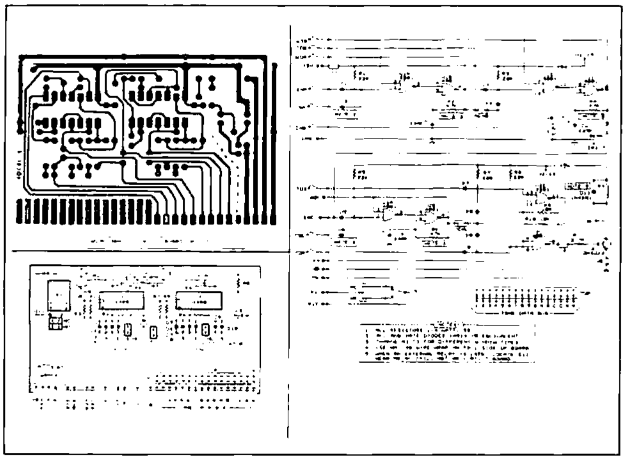


Figure 10. Four digit CRL foil pattern and schematic. Edge pins are on 0.2" centers.

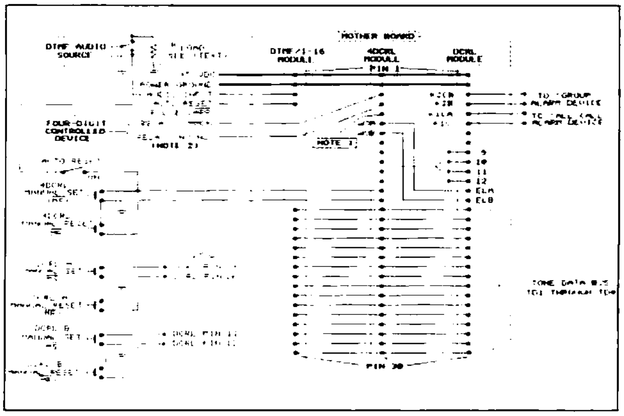


Figure 11. Hornblower Two Motherboard.

9. Install push-on jumper at AENB. NOTE: Turn power OFF prior to installing soldered-in jumper. Turn power ON to continue testing after AENB jumper is installed.
10. Connect voltmeter to U1 pin 10. Observe time of day (minutes and seconds) when transmitter is keyed and the DTMF key associated with *the previous WG and this WG's TD* selection is pressed. Again, measure the duration of window gate output (WOB) +5 VDC voltage.
11. Install push-on jumper at BENC. NOTE: Turn power OFF prior to installing soldered-in jumper. Turn power ON to continue testing after BENC jumper is installed.
12. Connect voltmeter to U2 pin 4. Observe time of day (minutes and seconds), when transmitter is keyed and the DTMF key associated with *the previous WG's and this WG's TD* selection is pressed. Measure the duration of window gate output (WOC) +5VDC voltage.
13. Install push-on jumper at CENL. NOTE: Turn power OFF prior to installing soldered-in jumper. Turn power ON to continue testing after CENL jumper is installed.
14. Connect voltmeter to Q1 collector. Observe power supply (DC source) voltage, dropping to NEAR ZERO VDC when transmitter is keyed and selected DTMF "ON" code is dialed. Use #30 wire-wrap wire and "white-wire" (patch) the collector of Q1 (CRL circuit) to the card edge. This allows use of an external relay with multiple, high-current "dry" contacts and/or an LED indicator to show latch circuit "SET" conditions.
15. Connect voltmeter to Q1 collector. Observe NEAR ZERO VDC, abruptly increasing to power supply (DC source) voltage, when transmitter is keyed and selected DTMF "OFF" code is dialed.
16. Place AUTO-RESET switch ON.
17. Set ohmmeter to a low resistance range. Connect ohmmeter to external device connector. Observe time of day (minutes and seconds), when transmitter is keyed and selected DTMF "ON" code is dialed.
18. Measure duration of AUTO-RESET interval, shown by change of ohmmeter resistance indication.

This ends the system testing procedure.

Uh, Oh!

There are a few corrective steps the builder must perform before operating the unit.

Find Figure 12 and locate the circuit board foil pattern for the decoder module (upper left). Scrutiny soon tells the reader that U102 pins 2,4 and 3,5 traces are reversed from that shown in the schematic. Use the following procedure to correct the circuit board wiring.

Locate U102 on the foil pattern. It is the 14-pin IC between the other two ICs. Near the trace junction of U102 pins 2 and 4, cut ⅛" from the foil trace connection between this junction and U103 pin 23. Leave the trace connection between U102 pins 2 and 4.

Continued on page 67

Parts List

Component tolerances for all Hornblower modules aren't critical. I chose commonly-available components. I suggest, however, that the builder choose parts with their physical dimensions in mind, so that they fit easily in their circuit board layouts. This simplifies construction and produces a more attractive finished module.

DTMF/1-16 Decoder Module

Capacitors

C101	0.01 µF disk
C105B	150 µF, 16 VDC electrolytic.
C102(*)	0.1 disk
C106(*)	10 µF, 16 VDC electrolytic.
C103	0.1 µF disk
C107(*)	0.1 µF disk
C104	0.1 µF disk
C108	0.1 µF disk
C105A	50 µF, 16 VDC electrolytic.
C109	0.1 µF disk

(*)Include these items when module is used with long power leads or unit is installed in a high RF environment.

Resistors (¼ watt, 5%)

R101	10 MΩ
R104	220 kΩ
R102	22 kΩ
R105	10 kΩ
R103	10 kΩ

Crystal

3.579545 MHz (Color Burst)

Sockets/Jumper Pins/Edge Connectors

IC101	18 pin, 0.3" spacing 20-edge connector, 90 degree male.
IC102	14 pin, 0.3" spacing 4-post connector, C/B Mtg., with push-on jumpers.
IC103	24 pin, 0.6" spacing

Transistor/Integrated Circuits

U101	SSI202, DTMF Receiver
U102	CD4001, CMOS 2-input NOR Q1 2N222 NPN, or equivalent 4-Digit Coded Relay Latch Module
U103	CD4514 1-of-16 decoder

Capacitors

C1, C2, C3	33 µF, 16 VDC Electrolytic

Resistors (¼ Watt, 5%)

R1, R3, R9, R10	10 kΩ
R5, R7	22 kΩ
R11	2.7 kΩ
R2, R4, R6	47 kΩ

Diodes

D1–D10	1N914 or equivalent.
D11	1N4001 or equivalent.

Sockets/Jumper Pins/Edge Connectors

IC1, IC2 Socket, 14 pin, 0.3" pin (row) spacing
29 edge connector, 90 deg. male.
10 post Connector, C/B Mtg. Male, TDP Connector, 32-Pin Female with 4 each push-on jumpers.

Relay

K1	5 VDC coil, with Form 1C (SPDT) contacts, 0.3" pin (row) spacing.

Components for the Hornblower are available from The Circuit Board Shop, PO Box 831555, Richardson TX 76083. These prices include shipping and handling:

4WG and DCRL boards—$7.00 each
DTMF/1-16 and 4DCRL boards—$11.95 each

73 Review *reviewed by Bill Clarke WA4BLC*

Datong's Great Add-On Filters

Super audio accessories

Datong Products
Price of FL3: $229.95
Price of FL2: $159.95
Price of ANF: $119.95

Happy are they that hear their detractions and can put them to mending. —Shakespeare

When I first received the Datong audio filters for review I thought, "Uh huh, more audio filters, just what the world really needs!" Well, I was wrong for thinking such negative thoughts. The Datong filters are just what the world needs.

For my primary operations I use a Kenwood TS-430 and ICOM 751A. The backup rig is a Drake TR3. Don't laugh! That old tube burner can still hear with the best of them, talk with the best of them, and I can fix it when it breaks, unlike the best of them. But, here lies the problem–it doesn't select with the best of them.

Operating in a crowded band is where the Datong audio filters shine. Like most older tube rigs, the Drake lacks top dollar receiver selectivity and the all important notch filter. . .the device that gets rid of the carriers produced by tuner-uppers and foreign broadcasts. I won't even mention what happens in certain parts of the seventy-five meter band where some AM is still spoken.

Now, by using the Datong audio filter, I can make the Drake sound as good as the best of them. In fact, with something only the Datong filter offers, I can make it better. More on that later.

Descriptions

The Datong filters come in three makes. The most complete is the FL3, followed by the FL2 and the ANF.

The FL3 offers a notch/peak filter, variable low cut-off filter, variable high cut-off filter, and an automatic notch filter.

The FL2 has the same line up of features as the FL3, except the automatic notch filter is not included.

The ANF is an automatic notch/peak filter with LED tracking.

The ANF is in a smaller box than the FL series filters.

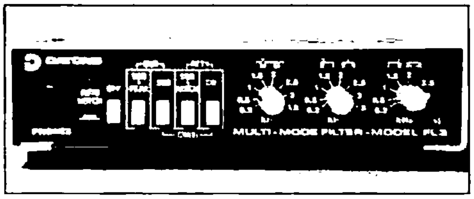


Photo A. The FL3 is full featured to provide complete control of received audio.

Photo B. Notice the 10 segment LED bar graph at the top of the ANF for displaying search and lock action.

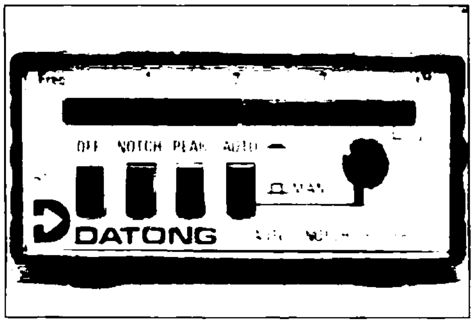


Photo C. The ANF is the best "black box" I have seen in a very long time. I strongly recommend it.

Features

The secret to a good receiver is selectivity. The better the selectivity, the better the receiver. A filter with very steep skirts is required for razor sharp selectivity. Using 5 pole computer optimized elliptic function filters, Datong provides just such filters.

The FL3 provides two filters, each with skirts that are movable from 200 to 3500 Hz. One filter is used for low cut-off and the other for high cut-off. Each filter section is independently voltage controlled. There is also a two-pole notch filter that can double as a peak filter. These filters can provide received audio equal to, or surpassing, that attainable from receivers having IF shift or Pass Band Tuning.

The automatic notch filter is perhaps the best feature of the FL3 (it's not found on the FL2). At the mere push of a button, any single steady tone that appears on the received signal is notched out. Now, let's try that again–is automatically notched out. The operator doesn't have to fiddle around with an overly sensitive notch filter control. The filter unit itself will do all the work.

Installation

The FL3 is almost as simple to hook-up as an external speaker. Just supply 12 VDC to the back panel, plug in an external speaker, and run a patch cord from the receiver's audio output to the filter input. This takes about two minutes. Other Datong filters install in a similar manner.

Operation

Before reading about my operational experiences with the Datong filters, please understand that I enjoy top quality audio. Anything less is not enjoyed (allowed) in my shack. To this end I have

used various external speakers, have tried many kinds of filters, and attempted a little voodoo. I even have an audio equalizer.

I did most of my testing on the seventy five meter phone band in the early evening hours. I feel this is the place that puts receiver selectivity to task as nothing else can.

The old Drake came out like gang busters. I was able to get on all my usual nets and listen for hours with virtually no interference. I used the high cut-off and low cut-off variables to create a narrow SSB filter effect, thereby eliminating the abundant squeaks and squawks that normally plague seventy five meters.

While I was listening, I selected various speakers and switched between the Drake, the 430, and the 751A. The results were amazing. The TR3 breathed with new life. The FL3's controls gave me the necessary receiver flexibility, similar to using the 430's IF shift and 1.8 kHz filter or the Pass Band Tuning and tone control on the 751A, to clean up the TR3's received signals. In most cases I found my receive audio much the same on all three receivers.

Notch filter action is good, very deep and quite sharp, yet typically difficult to tune (most are). Ah, however, there is the automatic notch filter. Its action is truly extraordinary.

In the past, when a tuner upper appeared on frequency, I had to reach for the notch control and slowly turn it until the offending whistle disappeared. Often it went away by itself before I could tune it away. Now, by merely turning on the automatic notch filter, the offensive signals disappear by themselves. No effort to me.

The automatic notch filter operates by continuously sweeping the 200 to 3500 Hz band searching for tones. When it finds one, it locks on it, then notches it out. The typical lock on time is less than a second. Not only is the acquisition speed of the automatic notch impressive; so is the depth of the notch. It took out every carrier I heard.

At first I wasn't sure the automatic notch was working. True, I was hearing no carriers, and the LED indicated lock on. But I didn't know for sure. By turning the filter on and off I confirmed that the filter was indeed doing its work. The manual notch can be used in conjunction with the automatic notch, allowing the elimination of two simultaneous unwanted signals.

I should mention this: Don't forget to turn the automatic notch filter off when operating CW or RTTY. It will effectively notch out the desired signals as quickly as it does away with offensive ones. It's automatic, not smart!

The FL3 has a CW mode that combines the low and high pass filters with the peak filter. The result is an excellent skirt effect with a peaked response. The peak frequency is easily tunable and the bandwidth is continuously variable from 100 to 1750 Hz. The filters provide a pleasing CW note, with no ringing. Ringing has plagued many audio filters, making them unpleasant, uncomfortable, or totally unusable.

"Uh huh, more audio filters, just what the world really needs!"

I also tested the ANF (Automatic Notch Filter). This unit is a stand alone notch filter providing manual and/or automatic notch and peak functions. It works as well as the notch filter found in the FL3 and provides a visual tracking of tone searching.

For CW usage put the ANF in PEAK mode. The unit will then peak desired signals just as effectively as the notch locks them out. Operating within the automatic peak mode, I found it was not very effective. The unit is so fast in seeking out signals that it jumps around between CW characters. It's best to tune for peak with the manual control. I did find this control quite sensitive, but remember, the filter is only 60 Hz wide in the peak mode.

Although the following is a small point, I feel it is worth mentioning. The ANF unit is very light-weight, and when set on top of a receiver it might be expected it to slip and slide around. Not so! The little box has small foam feet that hang on like glue.

Recommendation

I tested and used the FL3 and ANF for several weeks before writing this article. I am impressed with both. They do everything they are supposed to, yet don't appear to have any bad habits. I really cannot say enough good about the automatic notch filter.

I have tested other audio filters in the past, was not pleased with them, therefore never wrote product reviews about them.

Would I recommend the Datong filters? Sure do! In fact, I have mine in the main station speaker line, where it can be switched to any rig by the turn of a knob. It's an adjunct to all my rigs, not just the old Drake.

I think the ANF is a "must have" item for any shack. It sits quietly while it works and needs no attention except to turn it on or off. Considering the investment most of us have in our stations, I think the price of the ANF is quite modest.

The FL3 is the ideal match up for an older radio (Drake, Collins, Swan, National, Heathkit, etc.). It updates them into the modern world of high selectivity. The cost of an FL3 is considerably less than that of a new solid state transceiver.

I must note that I really didn't realize that the technology of audio filtering had progressed to the point where Datong has brought it. I think that the manufacturers of amateur/SWL receivers should take note of these fine products, in particular the Automatic Notch Filter.

Specifications

FL3

Input impedance: 5000 Ω
Nominal overall gain: unity
Filters: Low cut-off
High cut-off
Notch/peak
Automatic notch
Low and high pass filter frequency range: 200 to 3500 Hz
Minimum stop band rejection: 40 dBs
Rate cut off: 40 dBs in 500 Hz at 2 kHz
40 dBs in 120 Hz at 500 kHz
Notch and peak filter frequency range: 200 to 3500 Hz
Notch width: 200 Hz
Notch depth: 30 dBs
RTTY bandwidth: 100 to 1750 Hz at -6 dBs
CW bandwidth: 70 to 700 Hz at -6 dBs
Power output: max 2 watts
Power requirements: 10 to 20 VDC at 50 to 350 mA
Dimensions: 7.2 x 6.0 x 1.7"
Weight: 39 oz.
Accessories: comes with patch cords.

ANF

Input impedance: 100kΩ
Nominal overall gain: unity
Filter: 2 pole (Q of 30)
Notch and peak filter frequency range: 270 to 3500 Hz
Notch width: 200 Hz
Notch depth: 40 dBs
CW bandwidth: 60 Hz at -3 dBs (800 Hz)
Power output: max 2 watts
Power requirements: 11 to 18 VDC at 75 to 400 mA
Dimensions: 5.9 x 3.5 x 1.7" Weight: 17 oz.
Accessories: comes with patch cords.

Datong filters and other products are available from:

Gilfer Shortwave
52 Park Avenue
Park Ridge, NJ 07656
Orders 1-800-GILFER-1

Electronic Equipment Bank
516 Mill Street NE
Vienna, VA 22180
Orders 1-800-368-3270

Say you saw it in *73*.

You Will Upgrade!

Guaranteed to get you over the hump

by David Schoenthaler K0HBQ

Do you believe you can't pass the next level CW exam? You don't have to be a CW whiz to pass if you know how to properly prepare for and take the test.

Are you hesitant to take the next written exam because you don't fully understand the theory or because some of the formulas and schematics have you confused? The secret of passing any of the written exams is *knowing how to correctly answer the questions you don't fully understand*. You can do just that!

Have you failed the test a few times and now find yourself afraid to retake it for fear of failing again or perhaps thinking that it would be embarassing?

If you answered affirmatively to any of these questions but want that next class of license so bad you can almost taste it... then read on and upgrade!

The Exams Favor You

The CW exams are very generous when you consider examinees are not required to copy letter perfect for any length of time at all, and need only to correctly answer seven of the ten questions. This is more than fair. Why wait for a no-code license or settle for your current privileges when you *can* pass the next code test?

The FCC has gone about as far as it can go to make the written exams within the reach of practically everyone. Stop for a moment and consider:

The *exact* questions and *exact* answers are available as a study guide (totally unbelievable).

You can take the tests time and time again until you either pass, die or run out of #2 pencils, whichever comes first (almost unbelievable).

You get credit for test elements passed the next time you take the exam (unbelievable).

The tests are multiple choice rather than essay.

You can miss 25% of the questions and still pass.

The tests are given in your backyard at hamfests or local radio clubs rather than at examining points in major cities.

Think about these things. You can't ask for anything more. Their will always be a written test of some type, and we want that for the good of the hobby. Today's tests are designed to be passed... and you can do it.

> **"The FCC has gone about as far as it can go to make the written exams within the reach of practically everyone."**

Just reading this magazine and enjoying ham radio at whatever level you are now at is, in my opinion, indicative that you have enough intelligence to pass your next level of exam. If you want to upgrade but are not willing to put forth the effort, there is nothing wrong with that. You can remain a shortwave listener or stay at your present level of license and enjoy ham radio within those limits. However, if you are willing to work at it and make up your mind to do it, you will in fact upgrade. Ham radio is fun at any level of license... but it's a whole new ball game when you have more privileges such as working the DX stations in the lower portion of the bands rather than just listening to them.

The choice is yours.

Preparing For The Exam

The number one rule in preparing for the code exam is a positive attitude. If you have trouble learning the code or increasing your speed, it probably is because of a bad attitude.

4BO-1.1 What is a spectrum analyzer?
- A. A piece of test equipment used to display electrical signals in the frequency domain
- B. A test instrument consisting of two RF detectors, one connected to the input of the amplifier and one to the output
- C. A piece of test equipment used to display electrical signals in the time domain
- D. A piece of test equipment used for determining the maximum usable frequency

4BO-1.2 What type of instrument may be used to observe electrical signals in the frequency domain?
- A. An oscilloscope
- B. A spectrum analyzer
- C. A frequency counter
- D. A linearity tracer

4BO-1.3 How does a spectrum analyzer differ from a conventional time-domain oscilloscope?
- A. The oscilloscope is used to display electrical signals while the spectrum analyzer is used to measure ionosphoric reflection
- B. The oscilloscope is used to display electrical signals in the frequency domain while the spectrum analyzer is used to display electrical signals in the time domain
- C. The oscilloscope is used to display electrical signals in the time domain while the spectrum analyzer is used to display electrical signals in the frequency domain
- D. The oscilloscope is used for displaying audio frequencies and the spectrum analyzer is used for displaying radio frequencies

4BO-1.4 What does the horizontal axis of a spectrum analyzer display?
- A. Amplitude
- B. Voltage
- C. Resonance
- D. Frequency

4BO-1.5 What does the vertical axis of a spectrum analyzer display?
- A. Amplitude
- B. Duration
- C. Frequency
- D. Time

Spectrum Analyzer:
- electrical signals in freq. domain
- horiz. axis—frequency
- vert. axis—amplitude

Figure 1.

4BF-4.1 What does the term CMOS mean?
- A. Common mode oscillating system
- B. Complementary mica-oxide silicon
- C. Complementary metal-oxide semiconductor
- D. Complementary metal-oxide substrate

4BF-4.2 What type of integrated circuit is the 4000 series?
- A. TTL
- B. ECL
- C. RTL
- D. CMOS

4BF-4.3 What is one major advantage of CMOS over other devices?
- A. Small size
- B. Low current consumption
- C. Low cost
- D. Ease of circuit design

4BF-4.4 Why do CMOS digital integrated circuits have high immunity to noise on the input signal or power supply?
- A. Larger bypass capacitors are used in 4000-series circuit design
- B. The input switching threshold is about two times the power supply voltage
- C. The input switching threshold is about one-half the power supply voltage
- D. Input signals are stronger

Figure 2.

4BF-2.1 What is the schematic symbol for an operational amplifier?

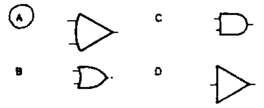


Figure 3.

It is very common to hear all sorts of negative comments about code, and I made a lot of choice ones. I refused to work CW for approximately 25 years, but then decided to upgrade and changed my attitude. I viewed it as a challenge, bought a used keyer and realized all of a sudden I was having fun working CW.

Change your attitude right now and decide to master the challenge. You will cut out a lot of drudgery and will learn it in about half the time. Plus it's fun! 13 wpm is within the reach of practically everyone and this is all it takes for an Advanced ticket.

The second rule in order of importance is practice, practice, practice by listening, listening, listening. You want to pass the test, and it is a listening test. Listen to W1AW, on the air QSO's and practice tapes. Keep pushing your speed up by listening to speeds faster than you can copy 100%. Listen to speeds you can copy letter perfect to give you confidence. Practice at least a couple of times a day. On occasion practice with some distractions in the background, because most test sites are less than ideal.

You also can get in a lot of practice without being at your operating desk. Whenever you have a few spare minutes—driving to work, waiting in line, on hold for a phone call, or anywhere else—look at an object or some printing and sound the characters out to yourself in code. Hear the words sent at various speeds. This is excellent practice and has been proven to be almost as effective as the real thing. Plus, it's fun.

Also make sure you get a copy of a Gordon West practice QSO tape for the level of exam you plan to take. These tapes follow the same format as the exam and are very helpful.

Avoid translating the letters you hear into visualized dits and dahs and then translating it to the actual letter. When you hear a di-dah you should immediately know it is an A. Do not add an intermediate step of visualizing the di-dah on paper. Translate once and once only or you won't make it to 13 wpm.

Learn to put a dash whenever you miss a letter. Do not dwell on letters you do not immediately know. Make a mark on your paper for *every* character you hear. By making a dash on the paper for characters you miss, you'll know exactly how many characters you have to fill in. Worrying over a missed character only guarantees you'll miss the next several.

Master the numbers and master them well. There will be at least two to three questions involving numbers on the exam. It's not good to be guessing numbers because you're either right or wrong.

4BE-3.11 How long does it take for an initial charge of 20-vdc to decrease to 7.36-vdc in a 0.01-microfarad capacitor when a 2 megohm resistor is across it?
- A 12.64 seconds
- B 0.02 seconds
- C 1 second
- D 7.98 seconds

4BE-3.12 How long does it take for an initial charge of 20-vdc to decrease to 2.71-vdc in a 0.01-microfarad capacitor when a 2 megohm resistor is across it?
- A 0.04 seconds
- B 0.02 seconds
- C. 7.36 seconds
- D. 12.64 seconds

4BE-3.13 How long does it take for an initial charge of 20-vdc to decrease to 1-vdc in a 0.01-microfarad capacitor when a 2 megohm resistor is connected across it?
- A 0.01 seconds
- B 0.02 seconds
- C 0.04 seconds
- D 0.06 seconds

4BE-3.14 How long does it take for an initial charge of 20-vdc to decrease to 0.37-vdc in a 0.01-microfarad capacitor when a 2 megohm resistor is connected across it?
- A 0.08 seconds
- B 0.8 seconds
- C 0.4 seconds
- D 0.2 seconds

4BE-3.15 How long does it take for an initial charge of 20-vdc to decrease to 0.13-vdc in a 0.01-microfarad capacitor when a 2 megohm resistor is connected across it?
- A 0.06 seconds
- B 0.08 seconds
- C 0.1 seconds
- D 1.2 seconds

0.01 Microfarad:	seconds
Decrease to 7.36 volts	0.02
2.71	0.04
1.	0.06
0.37	0.08
.13	0.10
Multiply by almost 3	$^2/_{100}$ increments

Figure 4.

Get on the air and operate CW once in a while for a change of pace. You might even have sweaty palms but that is normal. But remember... it's fun.

The Written Exam

There is a wide selection of study materials on the market. If you are fortunate enough to live in an area where study classes are offered by a local radio club, by all means enroll. Read and study as much as you can, because the more you understand the subject matter, the more you will enjoy ham radio.

"Don't let anyone hang a guilt trip on you for memorizing a few questions that you simply don't understand. Your goal is to pass the test."

The final phase of preparation is to obtain the most recent copy of the License Manual. Read through the questions and answers several times, circle the letter of each correct answer and then underline key words, key phrases or key numbers in each question and in the correct answer. Do this for *every* question. Review all of the questions several times before you take the exam.

4BG-9.1 What frequency range will be tuned by the circuit in Figure 4BG-9 when L is 10-microhenrys, Cf is 156-picofarads, and Cv is 50-picofarads maximum and 2-picofarads minimum?
- A 3508 through 4004 kHz
- B. 6999 through 7360 kHz
- C. 13.399 through 14.402 MHz
- D 49.999 through 54.101 MHz

4BG-9.2 What frequency range will be tuned by the circuit in Figure 4BG-9 when L is 30-microhenrys, Cf is 200-picofarads, and Cv is 80-picofarads maximum and 10-picofarads minimum?
- A. 1737 through 2005 kHz
- B 3507 through 4004 kHz
- C. 7002 through 7354 kHz
- D. 14.980 through 15.020 MHz

Freq. range from:	
10–156–50–2	3508 thru 4004
30–200–80–10	1737 – 2005

Figure 5.

4BB-1.1 Why does the downlink frequency appear to vary by several kHz during a low earth orbit amateur satellite pass?
- A The distance between the satellite and ground station is changing, causing the Kepler effect
- B. The distance between the satellite and ground station is changing, causing the Bernoulli effect
- C The distance between the satellite and ground station is changing, causing the Boyles law effect
- D The distance between the satellite and ground station is changing, causing the Doppler effect

Figure 6.

At this point, you will know which questions give you trouble. If you understand the question but can't remember the answer or you simply don't understand a question or block of questions, you have two techniques that will pull you through: outlining and memorizing. If these techniques work for law and medical school exams where you don't have the exact questions and answers available before the tests, they certainly will work on today's ham radio exams.

Outline every question and answer that you don't know absolutely cold by summarizing it in a separate notebook. Your underlinings will help; abbreviate as much as possible. Outlining is another step of imbedding the material in your head (reading–underlining–outlining).

Consider the example in Figure 1, which involves five questions and answers led to the simple outline shown. An outline does not have to be fancy or perfect. Your goal is to set forth the essence of a series of questions and correct answers in a brief format that you can understand.

Mnemonic Devices

Let's get a few things straight regarding memorization before we go any further. First of all, it is not cheating or dishonest to memorize the answers to some questions. Again, keep in mind that the questions and answers are given to us by the FCC. Sure there are purists in our ranks who frown on anything but total understanding of all aspects of the exams. My answer is that ham radio operators come from all walks of life, and many of us have no training in radio or mathematics. (I never could understand how someone who work with electronics all day for a living could come home and enjoy ham radio as a

hobby.) Don't let anyone hang a guilt trip on you for memorizing a few questions that you simply don't understand. Your goal is to pass the test.

Memory devices have been with us since grade school; e.g., Italy is shaped like a boot, and the lines on a treble clef of music are EGBDF, because we all know that "Every Good Boy Does Fine." To call Gambler's Anonymous dial 1-800-LAST BET.

The more ridiculous the association the easier it is to remember. For example, take a look at the four questions and answers in Figure 2 and the underlining. I have always been fascinated by trucks, and as I read this series of questions the word semi popped into my head (semiconductor). I then envisioned a shiny new white semi-tractor with 4000 in chrome numbers on the side of the hood pulling a half size trailer to get low gas consumption with CMOS in bold read letters emblazoned across the sides of the trailer. Ridiculous? You bet. Stick in my mind? Every bit of it.

An example of a less exotic association is Figure 3. The key word is "operational," and the left side of the correct symbol is shaped like an O.

Sometimes you have to use pure rote memory, because you can't come up with a ridiculous association. Figure 4 is a series of five questions that all start out with a 0.01 microfarad capacitor. For test purposes you can omit two megohm and 20 volts, because they are the same in all questions. The two variables are the number of seconds it takes to die down to certain voltage. I outlined the five questions and came up with two rules: "Multiply by almost three" and "2.100 increment." Memorizing one question and its answer will allow you to answer the other four by applying the rules.

Another example is shown at Figure 5. Look at my outline and the circled numbers.

You will note in Figure 6 that "downlink" is a catchy word in the question and "doppler" is the correct answer–both starting with "d."

Memory techniques work for any type of question whether it involves definitions, numbers or schematics. The secret is in using your imagination and pulling out a common thread, a ridiculous association, or a rule of thumb. Plus it's fun.

Taking The Exam

Thorough preparation is the basis for a feeling of confidence and positive attitude on exam day. Walk into the exam room as a winner with your head up—*you are going to pass!*

The night before the exam listen to the QSO format tape, study your outline and your memory aids. It's basic, but get a good night's sleep. Study some more the day of the test if you have time.

A few pointers on taking the code test:

Concentrate on what you are copying and don't try to read what you have written.

Leave a dash for each missed letter.

Copy the consonants the best you can. If you find yourself falling behind, skip the vowels and copy the consonants. It's easy to fill in the vowels when answering the questions.

Copy the main words the best you can. Omit the simple, meaningless words if you're falling behind.

If you anticipate a set of numbers coming because you're in the process of copying "Kenwood" or RST and you're falling behind, don't copy the full word. Copy the first part, then listen carefully to get the numbers.

If you don't know an answer to a question but you have some notes...take a guess. If you have some of the consonants and use your imagination the odds are with you.

The code tests are straightforward rather than being tricky.

Keep in mind while taking the written exam:

Put your hand over the answers while reading each question and then answer it in your head before you look at the possible answers.

If you don't know an answer, pass on to the next question and come back to it later.

When you go back to a skipped question, engage in a process of eliminating wrong answers. Act on a hunch; guess if you have no idea.

If the question calls for a calculation and yours is a few numbers off but is the closer to one of the choices, go with the closest choice.

Don't second-guess yourself once you've marked an answer unless you're sure you made a mistake.

Use some common sense and remember that you can miss 25% and still pass.

The choice of whether to upgrade is yours. Make the right one and get on with it.

Good luck! 73

73 Review *reviewed by Stu Norwood*

W5YI Novice Course

Gordon West's Radio School
2414 College Drive
Costa Mesa, CA 92626
Price: $19.95
Written by: Gordon West WB6NOA
and Fred Maia W5YI

Gordon and Fred, you've made the well-nigh impossible seem easy—well, if not easy, at least attainable. I'm confident, if anyone is ever **really** confident, that I'm prepared to go for my Novice license.

Wayne had been reminding me for a couple of years now that I don't have a callsign after my name. In critiques of the magazines I could usually count on him to point out that a callsign was missing after my name on the staff box.

But the last straw happened a couple of months ago when he said in his cheerful way, "You blankety-blank-blank turkey, when are you planning on getting your license?" Well, the timing of that gentle reminder couldn't have been better. I just happened to have a copy of the Gordon West Radio School's New Novice Voice Class handy on my desk. I waved the tape and license preparation books at Wayne, and gave my solemn oath: I'll get my license by April Fool's Day.

At this writing, I'm scheduled for my exam in a couple weeks. And as Gordon says, in his inimitable California accent, it was eeeeeasy! thanks to the technique, style, encouragement, and reinforcement of this class.

After a rousing musical introduction on the first tape, with greetings from Gordon and Fred, and assurances that Morse code was going to be eeeeeasy! I got down to work.

I walked my way through the letters, the dits and dahs of e, then **t** and a (Gordon says di-dah kind of sounds like an a looks). Then the dits and dahs began forming words—ate, tea, at. Just when I was expecting to master code in one sitting, Gordon warns that I shouldn't study for more than 20 minutes at a time.

The class moved on to new letters, n, **i, t, m,** s, **o,** s. My abbreviated alphabet then consisted of 10 letters. I already knew **v**, thanks to Beethoven. The rest would be eeeeeasy. The tape spurred me onward to a blazing 7 wpm, with Gordon's encouraging, "Hey, not bad, not bad at all!"

The rest of the alphabet began etching itself in my brain. R, u, **k** were easy, the latter two being variations of **r**. I mastered **cq** by listening to the rhythm. Punctuation, numbers, prosigns, were a cinch with the course's use of varying speed, random drills, and the continual reinforcement and coaxing. At the end of the second lesson Gordon says to stand up and take a bow. Somewhere in the distance, I think I heard the strains of Pomp and Circumstance.

On lessons 3 and 4, I stumbled on a few letters: **y, l, f, p.** But with continual repetition they, too, locked in.

During the 3 or 4 hour breaks, when Gordon suggests going out and mowing the lawn, or washing the car, dog, or cat, I had better things to do. I was immersed in the study guide's 302 exact word-for-word Novice test questions—complete with answers and explanations.

This is an excellent license preparation guide—Gordon and Fred are to be congratulated on the content, marketing, and packaging of their course. Morse code, after all, is fun, and it is easy. The colloquial, informal approach on the tapes works. It worked for me to break my mental barrier to code.

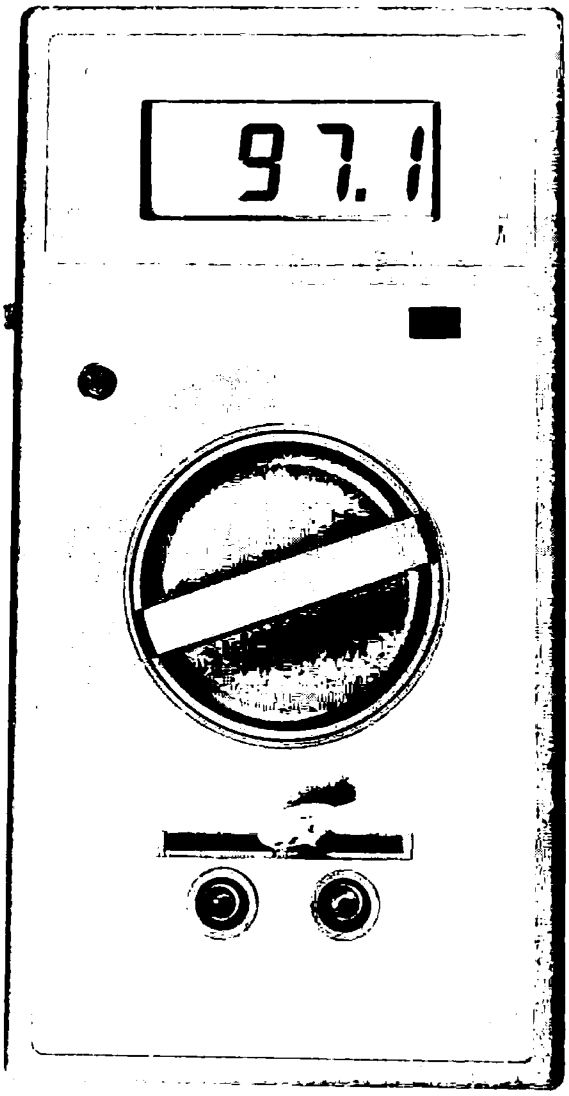
"Okay, you can break the seal on the VEC envelope." Hmmmm, what will my callsign be, KA1STU?

73 Review *by Larry Antonuk WB9RRT*

AR-460D 3½ Digit LCR Meter

Simply simplified troubleshooting.

American Reliance Inc.
9241 E. Valley Blvd.
Rosemead, CA 91770
Price Class: $200



Since the beginning of electronics, the faulty capacitor has been the bane of the troubleshooter. Difficult to test, often intermittent, usually "half bad"—the capacitor is probably responsible for more bald technicians than any other component. As long as there have been bad caps, there have been people whipping up devices to test them. The newest entry in the race is the American Reliance LCR Meter.

The LCR Meter measures just what it says—inductance, capacitance, and resistance. On the L and C functions we also get D-the Dissipation Factor. The unit is housed in a DVM-sized case, with a rotary dial to select function/range. A socket accepts components that can be plugged right in, and two three-inch test leads allow the user to clip larger parts to the meter. Once the components are plugged in, a slide switch selects L-C-Ohms or Dissipation. A fairly nice leather-like pouch comes with the AR-460D, with a separate compartment for test leads. The instrument is fuse-protected, in case the technician tries to measure the capacitance of a live circuit. In a show of thoughtfulness, the input overload fuse is easily accessible inside the battery cover, no tools needed. And even a spare fuse is included!

Measurement range of the unit is quite broad-up to 20 MΩ, 2 henries, and 200 microfarads. The capacitance range is somewhat limited, especially in these days of low-voltage power supplies. Accuracy is no worse than ± 2%, with most ranges being ± 1%. Measurements settle down quickly, with only the normal uncertainty of the least significant digit. According to the manual, the unit needs to be zeroed when testing caps and coils. This seems to be especially important when testing low value caps with the test leads in place. The zero control is right on the front panel, but needs a screwdriver for adjustment (actually, a small square tuning tool works best). The control itself is somewhat tricky to adjust, but should probably not have to be adjusted too often.

Obviously, the worth of an instrument has to be measured by how much time it saves the technician. In this case the user needs to ask just what parameters he needs to measure. The resistance, capacitance, and inductance scales are fairly straightforward. However, things tend to get fuzzy when applying the Dissipation Factor to real-life situations. They were obviously fuzzy for the author of the manual—a small booklet that skirted the whole issue. This is revised with one-page addendum concerning the zero adjust control. In addition, buyers get a copy of a magazine article entitled "The dissipation factor . . . and explanation." Unfortunately, it never really does give an explanation, but rather several formulas that lead to the conclusion that Dissipation Factor is simply the ratio of effective series resistance to capacitive reactance. Or the reciprocal of the "Q" factor. No one ever mentions why anyone would want to know the Dissipation Factor. Nowhere in the booklet, addendum, or article is there a chart that tells us what a good or bad DF is–0.1, 25, a million? The article makes reference to the DF being inversely proportional to the leakage current in a cap. This indicates that a high DF corresponds to low leakage—or did they mean the other way around? The fact is that leakage current is a very useful parameter, but the AR-460D can't measure it. Leakage current is ideally measured at the normal operation voltage of the capacitor. The LCR Meter uses a low voltage 1kHz waveform for its measurements. The unit will determine an out-of-range cap–but it can't tell if the cap will break down with 2.0V DC applied, regardless of how many formulas are used.

American Reliance has a good capacitance, inductance, and resistance meter, but they need to do some more convincing as far as the usefulness of the Dissipation Factor measurement. From a pure troubleshooting standpoint, the lack of a leakage function is somewhat of a problem. For someone who needs to identify unmarked caps, or perhaps hand-pick capacitors to meet certain tolerance values, the AR-460D is a reasonable value. ■

A Pulsed Bi-Phase Communications System

Part II: Demodulation

by William Hotine K6HH

Demodulator Details

Figure 6 is the diagram of the demodulator unit, designed for use at 455 kHz. The 455 kHz sine wave input at about 0.2V P-P is capacity coupled to pin 7 of U_1, which is a hex CMOS inverter. Four of the inverters have feedback resistors from input to output and are capacity coupled. These four inverters amplify the small IF sine wave signal to a 12V square wave at #10, which is inverted again at #12 and drives a Schmitt trigger at pin 12 of U_3 to further square the wave. This square wave is inverted at #10 and is connected to the phase comparator inputs at pins 14 of U_2 and 14 of U_4. U_2 is a phase lock loop centered at 455 kHz, with low-pass filter damping designed[3,4] to minimize the VCO frequency fluctuation, when disturbed by input phase deviations at #14.

The VCO output at pin 4 of U_2 is further squared by a Schmitt trigger at pin 2 of U_3, and then inverted at #4. The squared VCO signal at #4 of U_3 is applied to phase comparator input pin 3 of U_4. U_4 is already receiving the squared input signal at pin 14. The phase comparator output at #13 is filtered at terminal 9, driving an internal source follower with output at #10.

The pulse output signal at pin 10 due to signaling phase deviations is a narrow negative pulse for a leading phase deviation, and a narrow positive pulse for a lagging phase deviation. Deviations as small as one degree of phase produce clear five-volt pulses.

Small 10 pF capacitors couple these pulses to two high-impedance-input operational amplifiers of U_5. One amplifier is connected as an inverting amplifier, and the other as a noninverting amplifier. Negative pulses from U_4, which represent leading phase deviations, are inverted in an amplifier of U_5, the output of which at pin 9 is applied to a diode clipper, which removes the negative component and passes a 3V positive pulse to terminal 3 of U_6.

Positive pulses from U_4, representing lagging phase deviations, are amplified in a noninverting amplifier of U_5. Its output at #5 is applied to a diode clipper, which removes the negative component and passes a 3V positive pulse to #5 of U_6. U_6 is a hex inverter, and resistors bias the inverters to amplifiers at #3 and #5.

The inverted output at pin 2 is inverted again at pin 15 to give a 12V positive "one" pulse, which is connected to "AND" gate input pin 2 of U_8. Also, the inverted output at pin 4 is inverted again at #12, resulting in a 12V positive pulse to drive input #14 of U_7, a PLL centered on 19.6 kHz.

The pulse from #4 is the clock output and is connected to #9 of U_6 to delay it 180 degrees through inversion. The pulse from pin 10 of U_6 is the "clock" pulse and drives terminal 1 of the AND gate of U_8. The "ANDed" output at #3 is a clocked "one" pulse, which drives pin 12 of U_9, a monostable M.V. The output pulse width from terminal #10 is made slightly less than a clock period, so it returns to zero from each "one" for RZ data output. The pulse width could also be made slightly longer than a clock period for NRZ data output.

The system waveforms in Figure 1 (see last month) illustrate how the novel coding is used to encode a program of 101010.

System Recap

To summarize, the sine wave input signal is first squared in U_1, and then its rising edge is made even more vertical by the triggers in U_3, to enable accurate phase comparison in U_2 with its VCO square wave. This VCO square wave is then made more vertical in the trigger of U_3 and compared to the signal square wave in the digital phase comparator of U_4, thus enabling detection of one-degree phase deviations. The phase lock loop of U_2 locks to the average frequency of the continuous stream of lagging phase deviations at the middle of each clock frequency cycle, with the occasional leading phase deviation at the beginning of each clock cycle causing a variation of the VCO frequency of the PLL of U_2. Polarized pulses from #10 of U_4 are then processed in following circuits as described to give outputs of clock and data.

The frequency of 21.4 MHz at the transmitter was used because of availability of the single-sideband filter crystals on the surplus market. Power output was only ten milliwatts, and the antenna only two feet long, to prevent interfering with other transmissions on the amateur 15 meter band. I displayed the single sideband programmed 101010 transmitted at

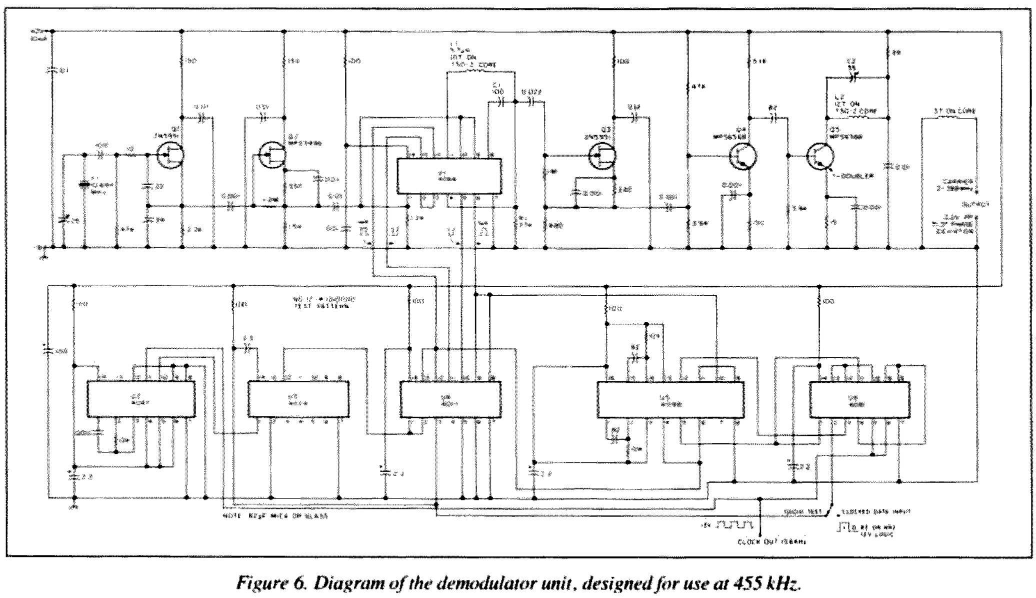


Figure 6. Diagram of the demodulator unit, designed for use at 455 kHz.

21.4 MHz on a spectrum analyzer with the sweep calibration 0.7 kHz per division. The signal bandwidth is less than 1 kHz. Random data would probably occupy a slightly greater bandwidth; the frequency excursion of random data would be greater than the test program of 101010.

This system definitely offers some exciting opportunities for experimentation: It uses simple circuits with inexpensive components, and the prospect for high baud rate data with a narrow associated bandwidth should stimulate interest on many fronts.

Idea For The Road

I have a new electronic typewriter with an LCD display of the typed before printing. Why not make a new digital communication method without computers (which are expensive)? A small keyboard with an LCD display of a few lines above it would comprise a small digital communication unit, a modern radio teletype system capable of written message transmission on any band, using the new digital transmission system, and would be comparatively inexpensive. Amateurs could easily make their own, like back in the old days when everybody did it! ■

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3. Best, Roland E. *Phase Locked Loops*. McGraw-Hill, NY.
4. Berlin, Howard M. *Design of Phase Locked Loop Circuits*. Howard W. Sams & Co., Indianapolis IN.

Ed. Note: Figure 4 from last month and Figure 6 from this month have been transposed. Figure 4 is the demodulator schematic, and Figure 6 is the transmitter schematic.

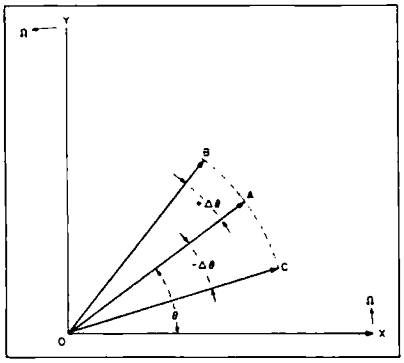


Figure 7. Vector representation of mechanics involved in the pulsed bi-phased digital modulation system.

Phase Modulation Details

A vector representation of the mechanics involved in the pulsed bi-phase digital modulation system shows the modulation action clearly.

Leading Angle Pulse

With reference to Figure 7, the XY coordinate system is spinning counter-clockwise with the constant angular velocity $2\pi F$, where F is the center carrier frequency. The line OA denotes the position of the unmodulated carrier current vector of length I_w.

When a rectangular leading angle pulse occurs, vector OA shifts to position OB during the rise time of the pulse and adds a small velocity to the angular velocity $2\pi F$. The carrier F returns to its original velocity during the dwell time of the flat top of the rectangular modulating pulse. During the fall time of the pulse, vector OB returns to position OA and subtracts a small velocity from the angular velocity $2\pi F$.

Phase modulation takes place during the nanosecond times of rise and fall of the modulating pulse only. One cycle of 10 MHz is 100 nanoseconds long. If we assume that modulation takes place in only 50 nanoseconds or less, then modulation products are produced only during one-half cycle or less of the carrier. At a modulating frequency of 20 kHz, one clock cycle is 50 µs long, or 50,000 nanoseconds. The time of modulation is then 50 divided by 50,000, which equals 0.1% of the average transmission time of a clock cycle.

Lagging Angle Pulse

When a rectangular lagging angle pulse occurs, vector OA shifts to position OC during the pulse rise time, and subtracts a small velocity from the angular velocity $2\pi F$. The carrier frequency F returns to its original velocity during the dwell time of the flat top of the rectangular modulating pulse. During the fail time of the pulse, vector OC returns to position OA, and adds a small velocity to the angular velocity $2\pi F$.

The phase modulation takes place in a similar manner to that described above.

For any pulse, the phase deviation from frequency F will then be $2\Delta\Theta$, where $\Delta\Theta$ is the phase angle deviation of the vectors. The sideband width will be $2f\Delta\Theta$ where f is the modulating frequency, and the sideband will be spaced f from the carrier. As there are 2π radians in 360 degrees, it takes 2π radians of phase angle deviation to change the carrier frequency F by one hertz. A program of alternate "ones" and "zeros" (10101010), which has two pulses for a "one" and a pulse for a "zero" has an average frequency of 1.5 f_c where F_c is the clock frequency. Then at the clock frequency of 20 kHz, with a phase deviation of .02 radians, we can calculate (2 x 1.5 x 20 x 20,000 x.02)/6.28 = 191 Hz, the width of a sideband.

This calculation gives less bandwidth than was shown on a spectrum analyzer, the accuracy of which is in question, because of the unknown factors in its response to signals of this type. However, the analyzer showed an 800 Hz bandwidth at a sweep time of one second. Slower sweeps which would give the narrow filter of the analyzer time to respond accurately were not available. The crystal carrier oscillator may also contribute some random phase noise which would widen the sideband.

As the sine wave carrier is modulated approximately only 0.6% of the time, and then only by a 1.2 degree phase deviation, it can be realized that the signal is a 99.4% pure sine wave, with a half cycle phase disturbance the only wave distortion. Maybe this accounts for the revolutionary narrow bandwidth of the system. Further mathematical analysis will explain this better than the writer can.

Information theory says that to transmit information at the rate of n bits per second requires a bandwidth of two times n cycles per second. To mark the start and finish of each bit requires that the signal be first turned on, then turned off. A cycle is defined as one full swing between on and off. Within a single cycle, it is not possible to know whether the bit is on or off. Within two cycles, though, one can determine whether both cycles are the same (bit on) or whether one differs from the other (bit off). In the case of the present system, bit off is 99.4% of the time, and bit on is only 0.6% of the time. This differs from sinusoidal modulation, in which the cycle periods are equal for both bits, and in which bits equal frequency.

Present information theory has been derived from these facts of sinusoidal cyclical modulation and does not apply to the new facts of the very fast transients used to phase modulate the carrier in the new pulsed biphase modulation system. In the new system, it seems that the least disturbance of the phase of a carrier occupies the narrowest bandwidth.

The noise problem is alleviated in the present system by its method of amplifying the received sine wave to the 12 volt logic level while preserving the crossover point of the sine wave as the leading edge of the logic level square wave. Amplitude noise equal to or greater than the carrier is amplified above the logic level and is thus cut off. It is well-known that a phase lock loop can track signals that are submerged in noise by use of phase discrimination.

The present system uses a digital phase comparator which is much more sensitive and accurate than the old phase comparators, and should be capable of tolerating a high noise level with undiminished accuracy, because noise cannot simulate a leading phase angle of a continuous sine wave and thus cause a false one to be detected.

A parting rhyme is apropos, answering all the theoreticians and mathematicians:

The bumble bee is oddly wrought.
Aerodynamically it ought
To find it quite impossible to rise!
But bumble bees don't know the rule,
'Cause bumble bees don't go to school,
They flies!

—Courtesy G3VMR

How Not To Run A Novice Class

Where visions of grandeur were mercilessly QRMed.

by George Willard KC0ES

I stepped confidently into the classroom. I knew I was going to revolutionize the teaching of ham classes. Rather than the crew of prospective Novices, my eyes were filled with visions of fame, fortune, and manufacturers eagerly pressing free samples of their latest gear on me, hoping to bask in the reflected glow of my prowess. . .

When and How It Started

I received my Novice ticket about a year ago. I felt like the king of hams when my Elmer told me he never knew of anyone going from Novice to Advanced in 91 days. Not really remarkable, but I didn't know that, either.

Soon after, I inherited a collection of amateur periodicals, the contents of which I eagerly read, including many articles on teaching Morse code.

Horrors! I discovered I had learned it all wrong! Elmer had handed out written sheets with the code *drawn out* on them! That was guaranteed to put a permanent 10 wpm ceiling on the victims of this system.

"Look, George," said Elmer, "I've taught classes for ten years, and turned out hundreds of new hams, including YOU. Why rock the boat?"

"But look here! It says in *QST* and other places that the only good way to learn code is by sound! Learning visually puts extra loops in the mental process!" I felt cheated. "I could have upgraded in three weeks if you'd taught me *right*!"

He fixed me with a measuring look. "Listen, hotshot, I don't go for all that psychology crap! In the Navy we learned the characters, and then it was just practice, practice, practice! But I'm willing to go along for the ride. They may have learned other new things since I started besides how to operate a rig without neutralizing it."

I blushed, remembering when I'd demonstrated my first station to him. The transmitter, an Old Viking Valiant, gave out loud hums and blinding blue light from the mercury-vapor rectifiers whenever I switched from standby to transmit. I sent with one hand on the key and the other on the VFO. I thought those old rigs were *supposed* to drift about 50 Hz per second!

"Anyway, suppose *you* run the next class. I'll go ahead and arrange for the classroom at the Army Reserve building. You find someone to help you do the class, and we'll see how you come out."

Heady with my victory over stubborness, I immediately drew up and printed posters for all the schools, electronic stores, and public bulletin boards in town. I sent notices to papers and radio stations, and went on a local TV talk show, to tell one and all of the wonders of ham radio!

When the big night came, I was *ready*! I carefully packed my books, sample magazines, a prepared list of letter lessons, 610 forms, home-brew, high-tech digital code practice oscillator (a quad NAND gate in a metal box weighing about 8 pounds and taking up ⅓ cubic foot), and—the *pièce de résistance*—a nice new Vibroplex bug! Elmer had always congratulated me on having a good fist, and I knew *this* would let me send good, clean, fast code.

I was a half hour early, as was Charlie, who agreed to help me in this endeavor. He came from the same Novice class, and was likewise forward-thinking and progressive. We had brain-stormed the night before, planning everything with a precision that would make Joint Chiefs of Staff envious.

The Motley Crew

Several students were already in the building when we arrived. One couple, obviously married, buttonholed us as we walked in the door.

"Is it true that a ham license will let my husband enlist in the Navy as a chief petty officer?" asked the petite blonde. I looked at her husband, about 6'2" and 350 pounds, standing behind his wife with head hung down and a wistful look in his eyes.

I turned helplessly to Charlie who had a baffled expression, similar to a Baptist minister when asked for the time of the Sunday School Orgy.

"Uh, I'm not sure about that. Maybe you ought to ask the recruiter," I replied, trying to stay on safe ground.

"We did," the small woman shot back, "and he just got a look on his face even dumber than yours!"

"Uh, dear," came a high, piping voice. I looked in vain for the pixie. "I'm sure if your brother said it, it must be true. I'll find out when I get to San Diego." Yeah. It was the big guy.

I turned from the odd couple and almost turned back. There in front of me stood a QCSSA (Quarter Century on Social Security Association) candidate wearing a cap with flashing LEDs, a propeller, and a transparent visor featuring a windshield wiper. A "Boogie in Your Rockin' Chair" button adorned the lapel of the broad-striped suit jacket worn over a pair of pink and blue plaid slacks.

"Hi, guess you must be the teacher!" this apparition boomed. "I'd hoped for a prettier one, but I guess you'll do—can't be too choosey at my age!"

As I backed away trying desperately to remember which door opened on the small-arms storage, he slapped himself on the knee and doubled over with a big laugh. "Gets 'em every time! I'm Farmer Fred from the morning Pig Pen Follies on Creosote, Missouri's, radio station! We call it Downtown Radio 'cause we cover about 3 blocks of downtown! I ain't learned nothin' new in nigh on thutty years, and I thought it was about time to try."

My near-shattered nerves were calmed by the appearance of a group of high-school students, a grandfather/grandson pair, a collegiate type, and several middle-aged people of average sex. I was not prepared, however, for the next student to enter the hall.

She had flaming red hair, a stunning figure, and an obvious aversion to heavy clothing.

"Hi, I'm Darlene Bedspread! Is this the radio class? I'm just so excited about becoming a ham! I just know one of those cute little two meter rigs I've read about will look great in my Ferrari!"

I became aware of an acute pain in my face. I realized my eyelashes had become snarled in my eyebrows, and the urge to blink was becoming stronger.

"Oh, I just love big, strong, handsome, fat geniuses like you! I hope we can work together closely."

I then observed the poor thing also had a phobia about undergarments. Gee, ham radio would be just the avocational therapy for her! I resolved to give her special attention. She obviously needed my personal help.

Just as I became aware of another pain growing in my jaw, my vision was blocked by the sight of a bulging shirt framing 13.37 square inches of hairy flab above a belt buckle that read, "I gave my sweetie a 12-gauge instead of a ring."

"Are you the teacher? How yuh gonna teach mah Darlin' Darlene an' me 'bout this here CB stuff if yuh cain't move yore mouth?"

"My trap slammed shut, cracking a tooth, as my dream of the life as a rich gigolo evaporated. "Uh, guess it's about time to start. Just go in there and find a seat."

The Class Gets Underway

Charlie emerged from behind the bathroom door, where he had taken refuge right after the first couple, and said, "Looks like a typical group, George."

With a deep, shuddering breath, I pulled myself together. He was right. A ham class is

made up of a "diverse" mix of people. Could I help it if this group was *really* diverse? We were confident, however, that our plan would work for *anybody!*

We walked into the room and onto the dais.

"Hello, class! Welcome to the wonderful world of amateur radio! This hobby is many things to many people, and just to start things off we'll tell you a little bit about us. I'm George, your code instructor, and this is Charlie, who will teach theory and regulations. Charlie, go ahead and tell the class how you enjoy amateur radio."

"Well, gee, George, I guess I didn't mention it when we were planning the class, but what with moving into our new house, the baby coming, and my chauffering the older kids to soccer practice, I haven't been on the air yet. But I sure want to say that I think it's a neat hobby, and I'm sure I'll get a rig one of these days and really enjoy it!"

"Uhhh. . .right, Charlie! Well, we'll just start off by going over the official FCC definition of amateur radio!" I felt like Monty Hall discovering that the contestants in the space alien costumes really were space aliens.

I looked around for the chalk. No chalk. I looked further. Still no chalk. Aware that the class was watching me as if they expected me to grow long ears and start braying. I was relieved to spot the Quartermaster passing by the door.

"Hey, Bill! Do you have any chalk?"

"Yeah, but its locked up in my office. You gotta have Form 16-526b Rev.8. You got Form 16-526b Rev.8?"

"No, but I'll happily fill out, in triplicate, if that's what it takes!"

"No, quintuplicate, but if you don't have a Request for Forms, number A93.787, I can't give you one, anyway."

"Can I get a Request for Forms, whatever you call it?"

"No, it takes a Request for Forms, number A93.787 to request a Request for Forms, number A93.787."

"Well," I said weakly to the class as Bill wandered off, "at least we know how to stop Russians. Steal all their Request for Forms forms, and in six months, they won't be able to move a lawnmower, much less a tank." This drew weak chuckles from the aspiring Navy Radio Chief, who was quickly silenced by his wife.

Starting off slow, Charlie and I gave them the requisite information, which they dutifully copied down.

"Okay, gang, now it's time for the code. Let me set up the old practice set, and you will start learning a new way to talk to others."

I opened my brief case and looked around for an outlet to plug in the oscillator. None on the dais. None on the wall behind the dais. Aha! there's one over on the side! Now to just slide the desk over that way so the cord can reach. . .

No way. Why didn't I think to put more than four feet of line cord on the box? Oh well, I'll just use one of the student desk-chair combos. Hmmm. These things are tighter than I remember from college days. Seems I overlap the desktop a bit. Never mind, there's plenty of room to lay my arm sideways in front of me. . .

Did you ever try to use a Vibroplex when it was sitting sideways on a slanted surface? Gravity on the weighted armature rendered the bug useless.

"Uhhh, that's OK, class. We'll learn to *speak* the letter sounds! That's a good thing, anyway, since you can practice code at home by sounding out the letters in books, signs, and so forth."

They looked at me with the silent skepticism of a group of rabbis attending a lecture on the virtues of pork farming.

"All right, let's start with the letter "A." Repeat after me. Di-DAH! A! Di-DAH! A! Di-DAH! A!"

This actually worked out okay, with the class soon getting into the spirit of things and di-dah-ditting messages back and forth. "Belt-buckle" was little slow on the uptake, which was all right, too, as Darlene beeped me some messages that should have been bleeped. That stopped when Loverboy, evidently more advanced than I thought, used ICG (Interrupted Continuous Growl) to specify just what he intended to do with me if I didn't keep my paddle fingers to myself.

Looking Good. . .

After about eight weeks, the class showed code proficiency, and, looking at their exams, I was certain that all had passed. Those were the days when the instructor sent the exams to Gettysburg for grading, so I gathered them up, thanked the class for their interest, got promises from all to call me as soon as their licenses came, and shook hands with Charlie as we walked out the door.

"I guess we showed Elmer that we can run a modern Novice class, huh?"

"Yeah, I suppose so, George. By the way, I think I'm going to give up ham radio and go into full-time youth athletic umpiring."

Well, there are just guys like that.

"Honey, I'm home! They all passed!"

"Hah! That *hussy* passed the first night, and every chance she got since!"

"Oh, come on! That was just innocent flirtation! She couldn't help herself. This hobby will be a big help to her."

With a suspicious look, my wife replied, "She could help herself, and I bet she has, plenty! Besides, I think she already has a hobby!"

"Well, it's over with now. Do you have any stamps?"

"No, I don't. Want me to mail those for you?"

I handed her the precious manila envelope.

Time Goes By. . .

After a couple of months, the phone rang. "Hello, George, this is Fred. Shouldn't we be getting our licenses by now?"

"Yeah, but they might have had a delay. I haven't heard from anyone else, so I'm still sure you passed. Let me know when they come in."

Three weeks later, I got a notice that there was a postage-due for me at the post office.

To my horror, I saw the clerk pull out a large manila envelope with a single first-class stamp in the corner, and the words "Dead Letter Office" imprinted upon it. The exams! Oh, NO!

"Government agencies will not accept postage due mail, and there was no return address on the outside."

I thought of calling all those students and explaining that their exams were invalidated because they didn't get back to Gettysburg within 30 days. I thought of Mr. and Mrs. Navy, Farmer Freddie, and Belt Buckle. I thought of my wife thinking of Darlene.

Three weeks later we moved out of our apartment and into a suburban home. With an unlisted telephone number. I wonder if the FCC will give me an unlisted license?■

Continued from page 6
use instead of being destroyed. He designed the early tuning units. I still have his original Model 12 Teletype and converter.

Then there was Sam Harris W1FZJ, whom I first worked and visited as W8UKS out near Cleveland in 1951. Another genius. Sam did much of the early moonbounce work. He's the chap who built the first parametric amplifier—on six meters. I believe it was this invention that gave MA/COM their big start as Microwave Associates. Sam moved to Arecibo and was an engineer on the big dish there.

He ran a VHF column for me when I edited *CQ* from 1955-1960. He was not only a genius, but had a world class sense of humor. I remember visiting him when he had the Arecibo dish set up on 1296 MHz. We were able to work hams all over the US and Europe via the moon.

I wrote recently about Ron Hessler VE1SH, another good friend. Ron did more for Canadian amateurs than any other ham. How much appreciation have you ever seen for his years of dedication and accomplishments? If we're not going to honor our heros while they're alive, I guess we can do it later, right?

So where were the honors for these hams who've done so much for our hobby while they were alive?

Timely Bouquets

We still have some old timers around who should be given our appreciation. How about some honors for these pioneers? Like John Kraus W8JK, who I think is still around? I used his Twin-Three antenna for years with incredible success. And many of us are using his helical antenna.

Then there's Copthorne MacDonald, the chap who developed slow-scan television. And Jack Babkes W2GDG, who pioneered narrowband FM back in 1946 and went on to start Sonar Radio to manufacture the first narrowband FM equipment?

Old timers will remember working Gus Browning W4BPD from dozens of countries. Gus still publishes a delightful DX newsletter. Too bad if you didn't work him from Sikkim, Afghanistan or many of the African countries. He sure made DXing a lot of fun for years.

More recently Lloyd and Iris Colvin W6KG have been giving us DXpeditions by the gross. And how about Danny Weil and the Yasme, back in the late 50s?

Brickbats

It probably isn't fair to run down the honor roll of hams who have made our hobby what it is without also giving credit to the scoundrels for their part in making the hobby miserable.

Let's see. . . I shouldn't forget Don Miller W9WNV, who fooled thousands of us with his bogus DXpeditions—like signing a Heard Island call when operating from near Vancouver. The last I heard he was in prison. Then there was Max Meyers W2BIB, who used to get his jollies jamming medical emergency and State Department traffic into Africa. And then there's the WØ I've always given credit to for inventing the imaginary DXpedition. He sat in a hotel room in Casablanca and signed the calls of six different West African countries. You have to admire original thinking like that.

We've lots more scoundrels for whom we can be proud. There's the couple who took ICOM for a few million—the two hams who scammed us out of hundreds of thousands of dollars with frequency counters (and, bless them, are at it again)—the ham who sold Collins gear he didn't have through *QST* ads (and was convicted)—the ham dealer in Chicago who was eventually convicted.

Back to Bouquets...

We've a lot more real ham heros we've shortchanged—like Boyd Phelps WØBP, Ed Conklin W6KA, Faust Gonset, Wes Schum W9DYV, who was the main sideband developer with his Central Electronics equipment, John Costas K2EN, who pioneered double-sideband for GE, but was out-politicked by Art Collins WØCXX and his single-sideband. How about Bill Welsh W6DDB, who's licensed more Novices than any other ham in history?

How about it? I'll bet many of you know a ham who should be honored while he's still alive. How about writing and telling me about him (or her)?

More Awards

If there are some who've become silent keys without our appreciation, I'd like to have you write about them, too. Have you any nominations for an Unsung Ham Hero award? Or for an Unsung Ham Scoundrel award?

Our hobby is missing something by not having such an honor—a formal honor. For many years, GE sponsored the Edison Award. Sometimes this was given for good reasons, sometimes not, so its value was diluted.

Bill Welsh got it back when he was generating Novices in the Boston area, before he moved to California and got the Lockheed Club W6LS involved. Since then he's given us a whole new generation of hams. That was an Edison Award I agreed with.

If you agree with me that there's a need to honor deserving hams while they're still alive—to let them know we appreciate what they've done to make our hobby more fun—then I'll arrange for the award to be financed and organize it.

What I have in mind would be much like the Nobel Prizes in concept. While we had just one Edison Award a year, I don't see why we can't honor more than one ham a year. If we think there is more than one who is really deserving, why not have two or three? These would be much like a college giving honorary degrees. Say, we could call it an ArD, a Doctor of Amateur Radio degree.

If you're serious about this we can get started right now. The first step would be to propose someone for the ArD degree. I'll set up a small group of ham industry hams to make the first sort. Their proposals can then be published so you can vote for the ones you think should be winners. The winners would be honored with a nice plaque at the Dayton Hamvention—and would also be featured on the cover of *73*. (See the 1988 Education and Technology Achievement Awards discussed in OpEd in the March issue).

I'll organize a Ham Industry Sifting Group. You start proposing hams you think should be honored. Though I'm tempted to have some sort of booby prize for the hams who've hurt us the most—who was that ham in Watts who devoted much of his life to being nasty on 20m? No, better we think positive—of chaps like Ralph Taggart WB8DQT, who's done so much for us with weather satellite facsimile reception. We've had some industry giants too, such as Rex Bassett W4QS, Leo Myerson WØGFQ, James Millen W1HRX, Ted Henry for his 2K amplifiers and Dick Ehrhorn W4ETO for bringing us the CX7 transceiver and his Alpha amplifiers.

An ArB (Blackguard) award is tempting, but who needs the law suits? Besides, if we had such an award, we'd have hams vying for it for sure—which we don't need.

Asia Again

With our dollar still dropping in value, in another year or two it may cost too much to visit Asia any more. If you can get away for just two weeks this October you can join me visiting Tokyo, Seoul, Taipei and Hong Kong. For a little more you can go on to Macau or China. Are you game for a little Great Wall climbing?

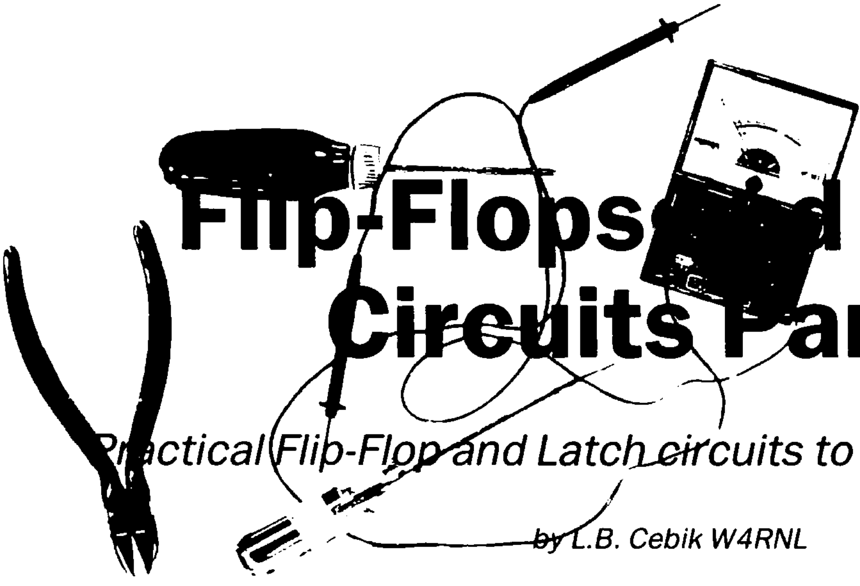
The tour leaves October 8th and will get you to the consumer electronic shows in all four cities so you can see what's going to be sold here next year. I'll be along, looking again for some manufacturing help from one of the hundreds of small firms that one can only find at shows like these.

This electronic tour is arranged by Commerce Tours and is expertly organized. First class hotels—superb breakfasts—several banquets. There are usually 150-300 on these tours, many of them hams. The cost? Around $3,200. If you're interested then block out October 8-23 on your calendar and ask me to send you the details. You'll have to sign up early so you can get the needed visas. Write Wayne Green, Asia, WGE Center, Peterborough NH 03458. Yes, you can come from anywhere in the world. Substantial groups from Europe and Australia have joined past tours.

I'll see how difficult it is to get a ham permit in Japan. That situation seems to have eased a great deal. Taiwan is still a problem, but you may be able to get on the air from BV2A while we're there. Hong Kong is a snap, so you might want to bring a 2m HT. I do.

It used to be easy to get a ticket in Korea, but then things got unfriendly. I'll see how the government is doing on this and let you know before we leave. I was issued HL9WG and made many contacts through a 2m repeater there on one trip. How friendly is Korea with Americans—and that's what it all comes down to—I'll let you know.

If you do decide to go on the Asian CES tour I'll guarantee you two things—One, you'll have the time of your life. Two, you'll never forget it. I've been going on this tour for ten years now and I still enjoy it enormously. The food—the fantastic sights—the wonderful people. You coming?



Flip-Flops and Latch Circuits Part 2

Practical Flip-Flop and Latch circuits to build, test, and use.

by L.B. Cebik W4RNL

Flip-flops as Shift Registers

A shift register is a circuit that takes data (one or more HIs or LOs) and moves it from one place to the next. Suppose there are 4 storage places, as in Figure 12. When taking the data from the state of the SI input, there is a serial input shift register. When taking data from the 4 PI inputs, the shift register is parallel input. It's possible then to move data from either source to the right toward output SO, the serial output. It shows the latest data after each clock pulse. The experimenter can also take the revised pattern of data from the PO terminals after each clock pulse. Thus, he gets the abbreviations SISO (serial in, serial out), SIPO (serial in, parallel out), PISO (parallel in, serial out), and PIPO (parallel in, parallel out), sometimes seen in shift register articles.

There are numerous all-in-one shift register chips, but these ICs have limited control capabilities. To see all of the controls one can exert on a shift register, consider basic flip-flops again. Just two 74HC74s can make a shift register, as shown in Figure 13. Once an experimenter has mastered the ways to control a shift register, he can select a more compact arrangement in a single chip if the application requires only a few of the controls.

The serial input goes to the data pin of the left-most flip-flop. Whatever value (HI or LO) appears here is shifted to the second flip-flop whenever the clock line shifts from LO to HI. That value continues to shift right with each clocking, since whatever appears on the D input appears at the Q output, which is connected to the next D input. The last Q output represents a serial output for the string of flip-flops. Note also that it's possible to use the −Q output for values opposite to the original.

The builder can also set the flip-flops with a parallel code. In Figure 13, LOs go wherever needed, since the resistors hold the Clear input HI in the rest state. LOs on the clear line immediately show up as LOs at Q and HIs at −Q, if beginning with the preset lines HI. In this case, tie the D input of the leftmost flip-flop to the positive supply voltage. Reverse this by holding the clear lines HI and impressing LOs on the preset lines (which would be HI at rest with pull-up resistors). A LO on preset appears as a HI at Q, and a LO at −Q. For this alternative, ground the D input of the leftmost flip-flop. Once the flip-flops are set, remove the LOs from the inputs. In other words, only a brief pulse at each flip-flop input line is needed to enter the parallel code. For these experiments, if the circuit is wired as in Figure 13, use a jumper to ground the clear line and then remove the jumper. Using the clear line removes the worry about debouncing the pulse.

Once a LO hits the clear input, the Q and −Q outputs change and stay changed until further input. As a start, place a LO on just the leftmost Clear input and watch it move along as the clock pulses proceed.

Once having entered the parallel code, it's possible to shift it right with a clocking pulse, just as was done in serial shifting. In fact, the experimenter can take the parallel code out the right end of the register in serial order, using either the Q or −Q output. Be sure that the first element desired is entered into the rightmost flip-flop and the last element desired is entered into the leftmost flip-flop. In a practical circuit, this operation requires a timing pattern consisting of a period of time

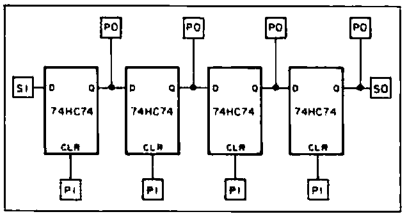


Figure 12. Basic flip-flop shift register.

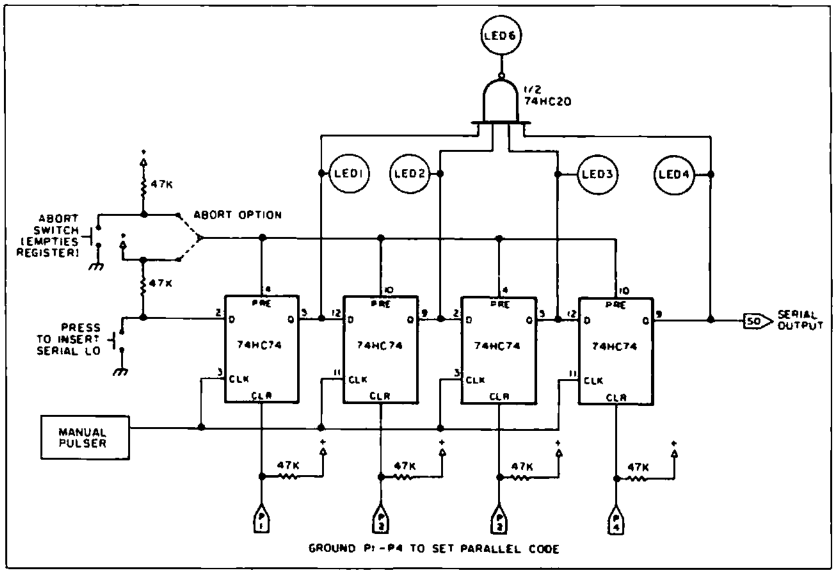


Figure 13. A parallel-code controlled shift register.

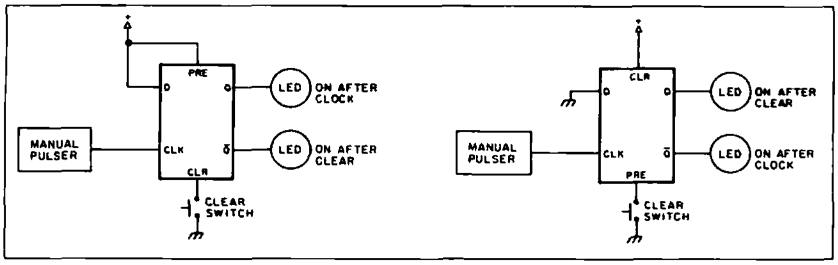


Figure 14. Basic flip-flop controller circuits.

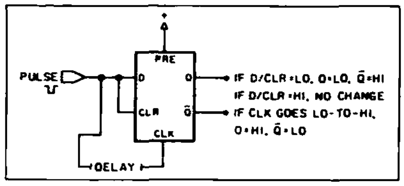


Figure 16. A delayed pulse controller.

to enter the parallel code and then four clock pulses to remove it serially. For these experiments, the manual pulser can move the code one step at a time and examine the results during these steps.

Why not take the outputs in parallel fashion from either the set of Q outputs or the set of −Q outputs? This allows some interesting possibilities. For example, if the register had 8 flip-flops, a user could enter an 8-bit code. Then he could use the rightmost four Q outputs to get the first four bits, clock four times, and take the last four bits from the rightmost outputs. Another application might use gates tied to each Q output to form a detector, such as the LED detector shown in Figure 13. If any flip-flop holds a LO from the clear input, then the clock keeps operating. When every flip-flop holds a HI (due to the HI on the leftmost D input, which fills in behind the shifting LOs), the detector might do something more than extinguish the LED. It might shut off the clock, preparing the register for a new code entry. This scheme would be applicable to both serial and parallel output uses.

Suppose a user wants to clear the register before it had gone through all its shifting cycles. In Figure 13, I made sure all the preset lines were HI so that the register would set properly using LOs to the clear lines and used only a brief set of pulses to the clear inputs. Setting the preset lines LO puts all the Q outputs to HI. With the detector just mentioned, the clock would stop, and the register would be ready for a new code entry. This type of abort operation may be handy in error detection circuits. Of course, if the register set initially with a code entry through the preset lines, making the clear line LO will force all the Q outputs LO, thus clearing the register in that mode of operation.

Given all these control possibilities, the user should probably start any register design on paper with individual flip-flops. Once having determined all the control needs, he then can look through the data books to see of there is a more compact shift register that provides what he needs with fewer chips and connections. The user can always go back to basics if he finds that a certain control will come in handy.

Among the 74HCOO-series ICs, there are numerous single package shift registers. The 74HC194 and -195 have 4-bit parallel inputs and outputs, but the 194 adds a serial input. The 74HC164 through -166, along with the -594, -595, -597, -598, -299, and -323 offer 8-bit shift registers in various configurations of serial and/or parallel inputs and serial or parallel outputs, with some limited controls that include tri-state outputs.

Flip-flops as Controllers

The basic flip-flop switch debouncing circuit in Figure 4 gave the most fundamental flip-flop control. That application didn't require data and clock inputs. However, for some types of control needs, those inputs come in handy.

Figure 14 shows one kind of control in two versions. Here a short enable pulse enters the preset or clear input to set Q and −Q. The control will involve a short-term operation turned on by the Q or −Q values. Note that the data input holds a constant value which—if clocked through to the Q and −Q outputs—would disable the operation. The applications requires a LO-to-HI transition from the operation that marks the completion of its work. (Of course, one can use a HI-to-LO transition by inserting an inverter in the line.) With the right transition, feeding it the clock input will shut down everything. For example, a builder might use the output of the shift register detector to signal when it was empty and shut down data code processing operations. The key points, again, are separate sources for start and stop signals and a constant value for the data input.

Figure 15 operates by similar principles, but in reverse order. Whenever the source has anything to pass on, it sends a LO-to-HI clocking transition. This passes on a HI from the D input to the Q output, where it signals a processing chip to accept the data. If the processor cannot accept the data, perhaps because it is full, it sends a LO to the flip-flop clear input, which overrides the clocking and holds the Q output LO. This controller forces a repetition of the data entry, because the flip-flop ignores the clock as long as the processor is not ready for values to process. The user may then employ this circuit to control the input of a storage buffer that follows a keyboard. When the buffer is full or not ready, a keypress will produce nothing.

A variation on these circuits appears in Figure 16. In this circuit, the tester ties the data and clear lines together and feeds them values. When the input value is LO, the clear line forces Q to be LO and −Q to be HI. When the input value goes HI, no change appears at Q and −Q. However, D is now HI. When a clock LO-to-HI transition occurs, Q goes HI and −Q goes LO. This

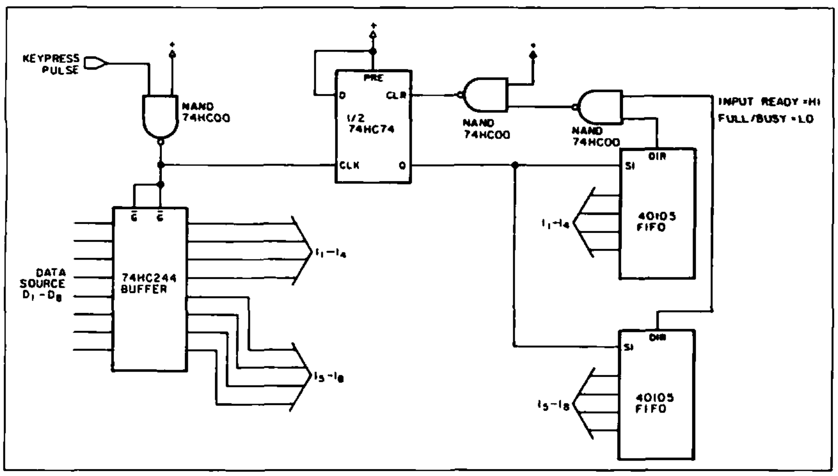


Figure 15. A practical flip-flop controller for a FIFO circuit.

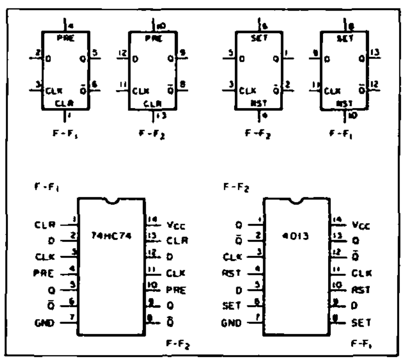


Figure 17. Comparative pinouts for the 74HC74 and the 4013.

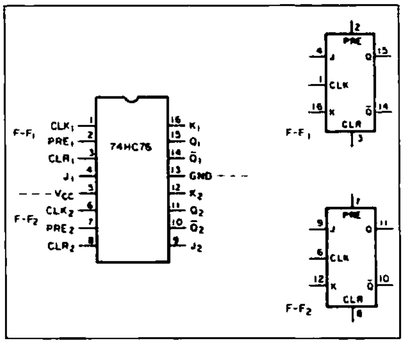


Figure 18. Pinout for the 74HC76 J-K flip-flop.

circuit is useful for controlling operations whenever the user wants to keep the operation going after an input (data and clear) value changes, but he doesn't want it to continue indefinitely. For example, he may feed the data and clear inputs regular pulses that are delayed farther down the line. The clock input may be the delayed pulse. Thus, Q or −Q might enable a certain process from the beginning of the regular pulse through the end of the delayed pulse.

These three circuits add considerable control versatility to the simple debounced switch in Figure 4. In most cases, a user will use signals inside his circuits rather than manual pulsers to control operations. Good practice will let the circuits control themselves wherever possible.

A Matter of Rules

Mastering any of these applications of flip-flops requires only keeping track of the chip's operating rules and priorities. For the 74HC74, the rules are straightforward:

1. The clock requires a LO-to-HI transition.
2. On a clock transition, whatever value D has appears at Q, and its opposite at −Q, if both preset and clear are HI.
3. Preset and clear input LOs override data clocking.
4. A preset LO forces Q to HI and −Q to LO, when clear is HI.
5. A clear LO forces Q to LO and −Q to HI, when preset is HI.
6. Never make preset and clear LO at the same time.

These rules tell what the possibilities are for the flip-flop. It's up to the user's imagination on what to do with these possibilities.

Other flip-flops have similar, but slightly different rules. The following two examples are for the CMOS CD4000-series D-type flip-flop and the J-K flip-flop from the 74HCOO-series.

The CD4013 D-type flip-flop, shown in Figure 17, obeys the following rules:

1. The clock requires a LO-to-HI transition.
2. Whatever value D has appears at Q, and its opposite at −Q, on a clock transition, if both set and reset are LO.
3. Set and reset input HIs override data clocking.
4. A set HI forces Q to HI and −Q to LO, when reset is LO.

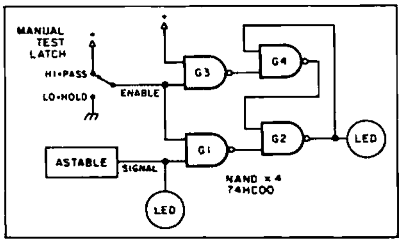


Figure 19. Basic latch circuit using NAND gates.

5. A reset HI forces Q to LO and −Q to HI, when set is LO.
6. Never make set and reset HI at the same time.

Note that the 4013 uses the terms set and reset rather than preset and clear to mark the difference in conditions that actively force values on Q and −Q. Also note that the pinout differs from the 74HC74.

The 74HC76 is a J-K flip-flop, meaning that it has two data input terminals, as shown in Figure 18. Its rules look something like this:

1. The clock requires a HI-to-LO transition.
2. If J is HI and K is LO, then a clock transition will yield Q as HI and −Q as LO, if both preset and clear are HI.
3. If J is LO and K is HI, then a clock transition will yield Q as LO and −Q as HI, if both preset and clear are HI.
4. If J and K are both HI, then clock transition will force Q and −Q to toggle or reverse their values, if both preset and clear are HI.
5. Preset and clear input LOs override J and K data clocking.
6. A preset LO forces Q to HI and −Q to LO, when clear is HI.
7. A clear LO forces Q to LO and −Q to HI, when preset is HI.
8. Never make preset and clear LO at the same time.

The 74HC76 uses a clock transition opposite that of the other two flip-flops featured here. The J and K data inputs offer the possibility of a two-line controlling circuit, as well as the potential for dividing by two by tying both J and K to the positive supply line and feeding the eariler 7555 astable output to the clock input. Every variation among the many available flip-flops offers new possibilities.

In fact, one manufacturer's data book lists 11 D-type flip-flops and eight J-K-type flip-flops. The ones looked at come two to a package, with each flip-flop independent. Some packages, such as the 74HC175 quad D-type and the 74HC78 dual J-K-type, have common clock lines. D-type flip-flops come 4, 6, and 8 to a package, but some have common clear lines and lack the −Q output. How compact the experimenter can make his divider, shift register, or controller may depend on just what input and output lines he wants.

Latches

The flip-flop is useful because a user can latch into the outputs values that appear only briefly at the inputs. The feedback shown in the basic flip-flop is the key to latching. There are also special ICs called latches. Although associated with flip-flops, they are not true flip-flops. However, latches do use a feedback loop with pass/block gates to freeze the state of a gate whenever the Enable line is set properly. Latches tend to use a slightly different vocabulary from flip-flops, so here are some lessons on how to use latches effectively in circuits.

Every time the user clocks a data value to Q and −Q with a D-type flip-flop, he has latched that value. Without the clock pulse, he block it from passing to the flip-flop output. Latch chips operate in the reverse manner. In an unlatched condition, they pass the input value to the output instantly. Only when placing the correct value on the latch or enable terminal is it possible to hold the output at the value last received. Remember, the value must reach the input before it can be latched.

The experimenter can build a basic latch from a single NAND chip, like the 74HCOO. Figure 19 shows how. Gate 1 looks like the simple pass/block gate used earlier in Figure 3. When the enable line is LO, the gate output is HI, but when the enable line is HI, the signal on its other input line passes (inverted) to gate 2. With enable HI, the inverter (Gate 3) passes a LO to one input of gate 4. That LO forces gate 4 to a HI output, which shows up

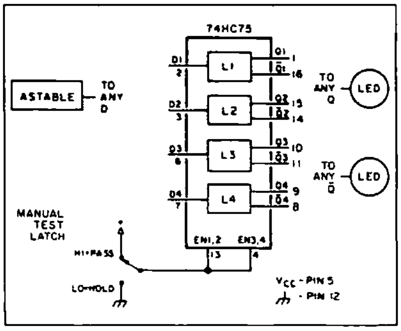


Figure 20. Test latch circuit using the 74HC75.

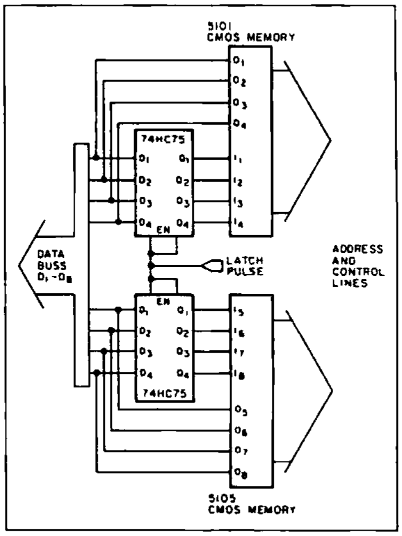


Figure 21. Latch control for memory input signals.

on the other input of gate 2, which in turn allows gate 2 to pass (and re-invert) the signal from gate 1. Under this condition, the output line Q looks just like the data input. When the enable input goes LO, the inverter puts a HI on one input of gate 4, allowing the gate to pass the signal fed back from the output of gate 2. This output will be whatever value gate 2 had when the enable line went LO, since that same LO now blocks signals from passing through gate 1. The gate 1 output stays HI, allowing gate 2 to pass the static signal circulating in the loop from gate 2 to gate 4. The user retains the output value of gate 2 as long as he holds the enable line LO. The condition of the circuit shows itself in the LEDs in Figure 19 as he catches and holds signals with the mechanical switch in the enable line.

He can build most of the circuitry of a latch directly on the IC chip, using only enable and data inputs, along with direct Q (and sometimes inverted −Q) outputs. This allows many latches on a single 14-pin or 16-pin IC. Figure 20 shows a latch circuit using the 74HC75 quad latch. The data input value appears at Q (and its opposite at −Q) so long as the latch input line is HI. When he brings the latch input LO, the Q and −Q outputs remain constant at the level of the last input value, regardless of date input changes. Using the astable pulser as a data source, the test latch uses the same mechanical switch to catch and latch the output before a pulse changes levels.

Latches are useful wherever the user wishes to hold a value temporarily. Figure 21 shows a simplified schematic of a set of latches receiving data in short pulses. However, the latches feed a memory chip that requires a relatively long time to write the data into its cells. (Here, short may mean 10 to 20 nanoseconds, while long means 200 to 300 nanoseconds. They are both short, but the difference is a ratio of ten-to-one.) If he can signal the enable line before the data disappears and hold it LO until the memory has finished writing, the proper data will be present at the memory inputs throughout the write cycle.

> *"It pays to master the flip-flop for its versatility."*

Latches come in many packages for many purposes. Eight-bit (or octal) latches, such as the 74HC373, are useful for capturing computer and other kinds of parallel codes that do not last long. These latches usually have only the Q output. Once latched, a memory chip or other kind of processor can take the time it needs to do its job. Such chips usually have only one or two latch enable inputs to control all the latches simultaneously. When scanning data books in search of the right latch, be sure to read the rules. Most require a LO to latch, but some (such as the 74HC4511 Latch/Decoder/Driver) need a HI or a LO-to-HI transition. The experimenter may find the latch input called Latch, Enable, Control, or G. Newer chips have tri-state outputs for use on buss lines, so be sure to distinguish the latch control from the output enable or control line. One convention calls the output control OE if it requires a HI for output enable and OD if it requires a HI for output disable.

There are many other chips that use flip-flop and related circuitry, usually in conjunction with gates to perform specialized function. I have noted the 74HC4511, which latches a count, transforms it into signals for a 7-segment display, and provides enough drive to light the LED segments. Many data books show representations of internal circuits reduced to the level of gates and flip-flops. If the digital gate is the most fundamental internal IC circuit, the flip-flop is surely second. But remember that at heart a flip-flop is just a special arrangement of gates.

It pays to master the flip-flop for its versatility. And it pays to keep a data book handy when designing digital circuits. At today's prices, manufacturer's data books are a bargain, whether the tinkerer majors in LS-TTL, CMOS, or high speed CMOS. Once having learned how to decipher the rules for a particular flip-flop, the IC offers a large array of useful circuits and an unending source of experiments.

Problems in Learning the Code

Tips for Code Class Teachers

by Larry Lisle K9KZT

For some people, learning the Morse code is a real challenge! While many sail through the requirements for Novice, General, and even Extra class tickets with no great difficulty, others have found so much frustration in even passing the five word-per-minute Novice test they gave up and never became a ham.

In this article, I'd like to offer some suggestions for helping students who have a hard time mastering the code.

The Long and Short of It

The initial hurdle in learning the code is telling the dits from the dahs. (For the newcomer, we never speak of the code in terms of dots and dashes, but in short sounds and long, such as, "dit" and "dah.") An instructor, at the end of the first session, usually identifies the faster and slower learners in a group on this basis alone.

The techniques I've found effective in overcoming this problem is to emphasize the difference between the two sounds. Once this has been established, gradually diminish the difference as progress is made.

• Method 1: Make the dahs longer than standard.

The standard dah sounds three times as long as the dit. I've found that sounding the dahs four, or even five times longer than the dit is a great help. This sound is easily accomplished with a hand key, but it's usually easier to change a computer program if using a computer generated code. The dah/dit ratio can even be made part of the menu.

• Method 2: Send the dits and dahs at a different pitch.

By using a keyer paddle and two code oscillators, a different pitch can be made. The code oscillator on the dit side should be at the usual tone of 700 to 1000 Hz and the dah oscillator somewhat lower. Of course, the dits and dahs won't be automatic or self completing, but with practice it's possible to send good code this way. This is a very good way to introduce all students to the code, and and as they progress, the difference in pitch should be reduced.

• Method 3: Involve the other senses.

Some people learn best by what they hear, see, touch, or the motions they make.

To stimulate the visual sense, use a flashing light along with a code oscillator, either for both the dits and dahs, or for just one of them. To involve the sense of touch, let the learner rest his or her fingers lightly on a speaker as the code is sent. The motion or kinesthetic sense is simply a matter of letting the learner send with a straight key or a paddle wired as a sideswiper—dits to the right, dahs to the left, one at a time.

In real problem cases, all of these can be used at once.

For home practice, every student should have either a keyer, a code oscillator, or a buzzer. Also, a student might want to use a tape recorder to record class practice sessions for review or to record their own sending.

Confusing Characters

Confusing opposite letters, such as K and R, E and D,or similar ones, is often a problem.

The best solution is to be careful of the order in which the letters are taught, and not moving on until they are mastered. I've tried

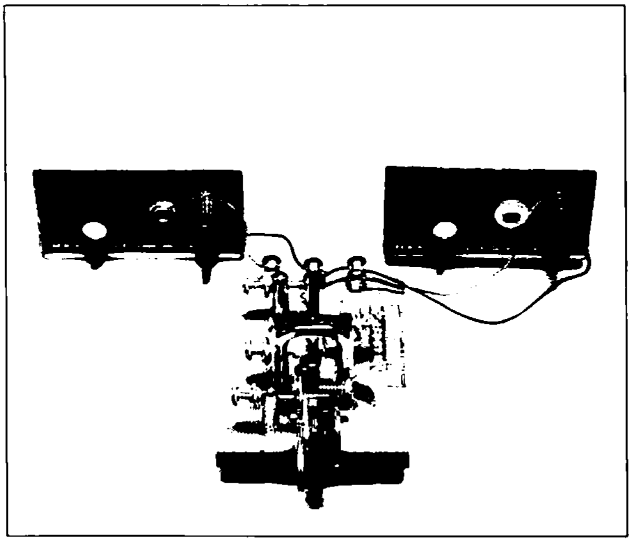


Photo A. Here's a setup for two-tone code. The "dah" oscillator is keyed when the paddle is pushed to the left with a slightly lower pitch than the "dit" tone.

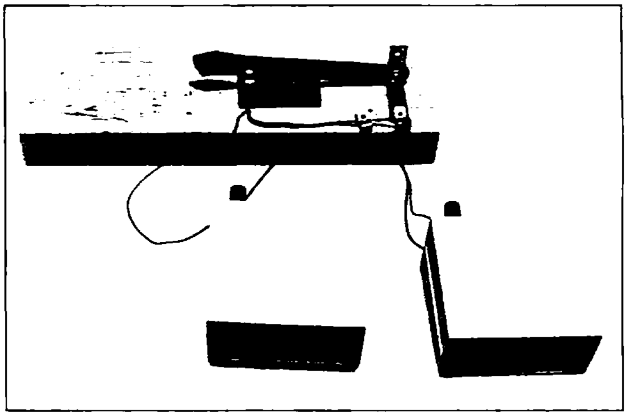


Photo B. Don't have a commercial paddle? Make one from an old knife, switch and some scrap brass.

different orders, but the one I've found most effective is 5 and Ø (to teach the dit and dah sound). I then started with E T A R, S L U Q J, H O N C V, I B Y P, W K Z M, D X F G. This order is from the ARRL publication *Learning the Radiotelegraph Code*. Note that the similar and opposite letters are well separated, but it's possible to send many words even during the first session.

The students should also be warned, in the preliminary instruction, not to learn characters as opposites. If there is a character confusion problem, don't try to treat it by "di-dah is A, dah-dit is N". Instead, re-teach one of the letters along with one letter from another pair with which the student has trouble.

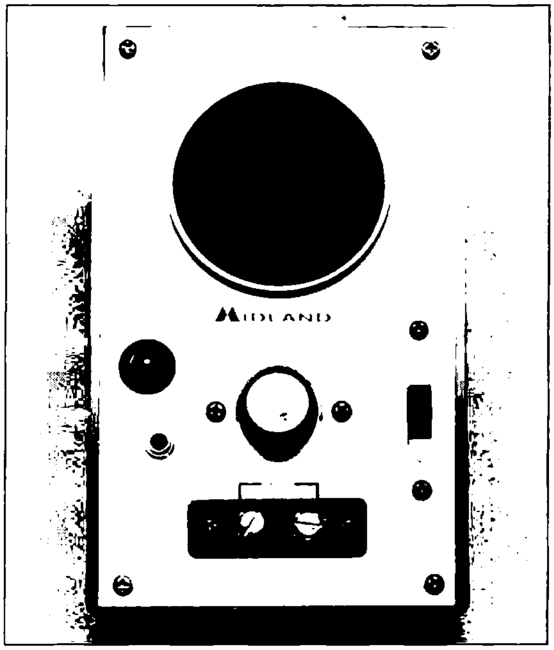


Photo C. Here's an oscillator with a built-in light. "Seeing" the code helps some students.

Writing Problems

While many CW operators do most of their copying "in their heads" and make only occasional notes to pass the test, the student should be able to write down everything he or she hears. The instructor should be aware of some of the bad habits students can acquire in writing, and correct them as early as possible.

One of the problems is writing too neatly. Another is writing dots and dashes for letters they're not sure of. And a third is vocalizing the dits and dahs as they are sent. In the early stages of instruction, students start vocalizing when the code is being sent very slowly. They then have to unlearn this as the speed increases. The ideal setup is two instructors: one to send the code, and the other to walk around and see what's happening.

Also, watch for the student who writes vertically down the page instead of across. This might be acceptable for the test since it keeps the student from reading and thinking about what they're copying and from becoming confused, but it won't help them on the air!

Lack of Progress

Sometimes students seem to get "stuck" at a maximum rate. This is called a plateau, a leveling of their learning capabilities. Since it doesn't happen to everyone or perhaps even most people, I don't mention the plateau until it starts to bother a student. Then I just tell him or her that it's normal and not to worry about it. We then sit down and go over their practice copy to see what letters are giving them trouble. I point out that only a few characters need work, and then we emphasize on them in future practices, two or three at a time. Other tricks include sending faster, say at seven or eight words per minute, and then slow down to five words per minute to make it seem easier. End the sessions with easy copy to leave the students on an "up" note. Don't let the student dwell on the idea of the plateau, or they will make it a much bigger problem than it is.

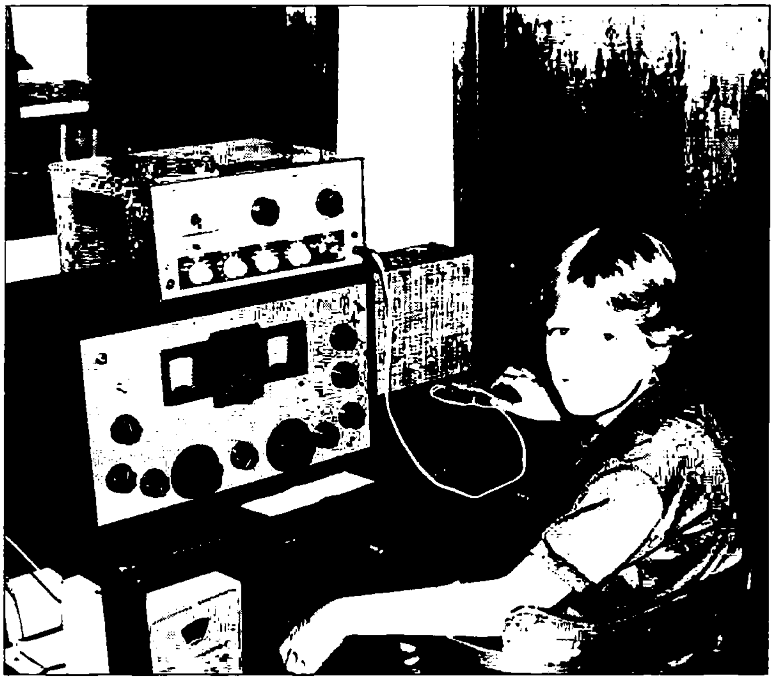


Photo D. The code isn't all hard work! Just ask Matt White KA9VEY.

Test Taking

Some people are not good test takers. There are at least two ways to handle this in teaching the code. The first is to give the students a test when they don't know they're taking one. Counting a routine practice session at five wpm as the test (one minute solid copy), copying a QSO off the air and then casually asking questions will help with testing practices. The only problem with this approach is that they'll be just as nervous during their first QSO as they would be for a test, causing the student to not be able to learn to copy under pressure.

A second way to approach the problem is to tell them that everyone is nervous during a test, but taking a test is seldom fatal. The worst thing that can happen is that they'll have to take it again. (Fortunately, the thirty-day waiting period is a thing of the past!) Then try to get the student almost solid at six or seven wpm and go for it! If they can't, try plan A!

The final decision is up to the instructor, but be careful about hard and fast decisions. There are always exceptions.

Discouragement

It's easy to become discouraged when the student has been working at something for months and still hasn't accomplished it. It's even harder when one student starts with people who took the test the same time and passed it within a month with seemingly little effort. When this happens it's up to the instructor to be a cheerleader, a coach, and a counselor.

Studies have shown no correlation between learning the code and general intelligence or other aptitudes. It's just one of those things like math, sports, art, or cooking, that some people have more natural ability at than others. Show the student the progress he or she *is* making. Tell them tales of people who had even more trouble, but finally made it. Change the practice routine, if the characters were sent fast with long spaces, try the normal rate. Sometimes just a different tone on the code oscillator can make a difference. Try lots of different things. At least it will distract the student from discouragement!

To summarize, a ham code class should be a school without failure! Be positive, be patient, and be flexible. The student only needs to pass the test once. ■

SECURITY ALERT!

Part 6 in the Tech Nomad Series

by Steven Roberts N4RVE

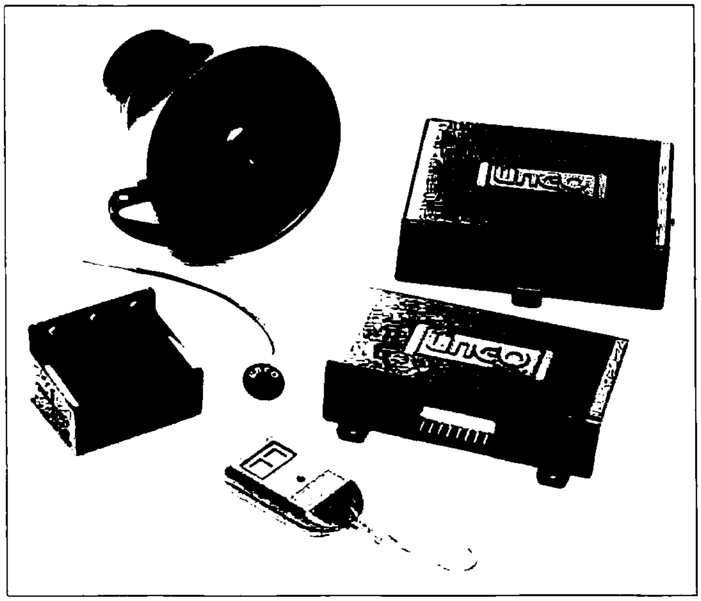


Photo A. The Ungo Box security system, which ranges from $140 to $350 depending on configuration, is an essential element for Steve's peace of mind. Contact Techne at 800-227-8875 (US), or 800-637-3366 (CA).

Here Today, Gone Tomorrow?

Sometimes I have no choice: I must turn my back on the Winnebiko and trust the public to leave it alone. And yes—to answer a frequent question—it usually makes me nervous. For as somebody wrote in a bicycle magazine once, "the best lock is the human eye." Those who drive around with thousands of dollars in ham radio equipment know exactly what I mean: you go downtown, park, have a flash of paranoia, then either stuff everything of value into a suitcase or get a hotel room with a view of the parking lot. . .probably spending the night in half-sleep, jumping up at every sound to see if some criminal is about to become an unlicensed ham.

My problem is even worse. The bike not only has no locks (except for a cable, which is essentially useless), but it also attracts curious people the way a pussycat in heat lures cruising toms. So far, I've been lucky. A few drunks have sat on it and a few kids have flipped console switches, but nobody has actually tried to STEAL it. Perhaps those so inclined have been stopped by the vague realization that they'd never get very far. The average thief would either fall over at the first traffic light or be so overwhelmed by questions from onlookers that he'd give up and go back to anonymous purse-snatching.

But still, I worry. Maggie and I haul our bikes into cramped motel rooms, up steps, and into peoples' houses just so we can sleep at night, since risk-management theory suggests that the probability of a loss multiplied by its severity is the figure to think about. The former may be low, but the latter is astronomical.

That's why the Winnebiko has a security system.

The Security System

The heart of the people-detector is an Ungo Box, intended for automotive use and made by Techne of Palo Alto, California. Divested of its usual packaging, it takes the form of three circuit boards mounted on standoffs inside the bike's console.

The main board houses control logic and the motion sensor, which is an immensely clever device that looks like a mercury switch inside a tightly-wound coil. It's not a switch at all—even the subtlest ripple of the mercury affects the flux density inside a 40 kHz field, which is then amplified and filtered by associated circuitry. I'm told the company's latest model allows discrimination between motion and shock, which lets one reduce falsing from the normal wind-driven resonance of the car.

The second module is a 300 MHz digital receiver, which listens for commands from a key-ring transmitter with a range of about 100 feet. As I'll note in a moment, I can carry the command options quite a bit further via 2-meter FM, but the basic Ungo Box allows the user to arm or disarm the system without physical contact, trigger an auxiliary 12V pull-down control line (such as a door lock or engine starter relay), or immediately sound the alarm in "panic mode."

Finally, there's an 11-meter transmitter that generates a 4-watt tone-encoded signal when told to do so by the control board—or when it detects shock through its own piezoelectric sensors mounted on the bike frame. This is actually a carryover from my pre-Ungo security system, but the company sells a comparable paging product with a range of a few miles.

Three Security Levels

There are basically three responses to a security alert, depending upon software and

the position of a hidden switch. The usual mode is page-only: the machine beeps me when someone touches it. Normally I leave the siren off. Its 130 dB wail is enough to seriously alienate anyone nearby (especially if it takes me a while to drop my fork, extract pasta from my beard, dodge waiters and tables, wait for an elevator, and sprint out the door to disarm the thing). But sometimes the siren's acknowledging chirp upon being armed is a good deterrent—that, along with a few blinking lights labeled "security status," lets people know that they should look but not touch.

If the bicycle-control processor is alive, then an additional level of "protection" is added, the efficacy of which is entirely dependent upon the personalities involved. A few weeks ago, a fiftyish woman had the gall to sit on the seat—whereupon the bike made a loud gunshot sound and firmly said, "Please do not touch me!" She leapt up, startled and embarrassed, and apologized to it. A heavily made-up friend of hers with a cigarette walked over to see what all the fuss was about, and I couldn't resist: I transmitted a touch-tone command that caused the bike to say, "This is a no-smoking area." The two of them guiltily backed off about ten feet, speculated awhile, shook their heads in bewilderment, and left...glancing a few times over their shoulders to make sure it wasn't rolling after them with evil intent.

Unfortunately, it doesn't always work that way. Some people keep touching the bike over and over to hear the Votrax synthesizer talk, realizing quite accurately that there's no bite in the system's level-two bark: "Do not touch, or you will be vaporized by a laser beam..." Children, depending upon their sophistication, either respond with delighted glee or flee in terror. "I just wanna buy the part that gets rid of the kids," quipped a Florida ham upon witnessing the latter response at the Orlando Hamcation.

The nice thing about a motion sensor is that it responds to the movement of anything physically connected to it. As such, my trailer is just as protected as the bike—and until we installed an Ungo remote sensor on Maggie's machine, all we had to do was park it in contact with mine.

Coping With False Alarms

OK. Getting beeped when the bike is touched is fine, because it makes it possible to turn my back on the damn thing and think about something else. But the problem is that MOST alarms turn out to be caused by someone wiggling the handlebars ("Oh look, here's how he steers it!"), stroking the seat fabric, or finger-drawing WASH ME in the road dust of my fairing. Neither event is serious enough to warrant *columnist interruptus*. And the last thing I want to do in the middle of a breakfast of champignons is stand on the sidewalk and try to explain, before the omelette cools, what all the switches do.

That was the motivation behind the 2-meter touch-tone link between an HT and the bike.

I have referred earlier in this series to remote control of the speech synthesizer—basically a means of selecting one of a stored repertoire of pre-programmed speech strings via a 20C90 on the 68HC11 I/O bus. Other commands allow direct control of the siren, the flasher, and the security system itself—and originally, I set it up to allow (n) seconds of local audio to be transmitted back to me on demand. The trouble with that, however, is that the language of bystanders does not necessarily adhere to the stylistic standards set forth in Part 97 of the FCC regs...specifically those having to do with obscenity. Telling the bike to transmit what it hears on 2-meter simplex is more than a little risky.

[redacted]

So I'm on the lookout now for a good deal on a pair of 49 MHz transceivers, one of which can be PTT'd by remote control and the other of which will live in my "off-bike" package. With the addition of a second packet TNC attached to my laptop computer, I'll be able to sit in a restaurant and carry on a very convincing "live" conversation via the synthesizer. Frivolous?

Not at all. Arthur C. Clarke once noted that "any sufficiently advanced technology is indistinguishable from magic." When the objective is security, a bit of trickery can go a long way toward keeping those of low motives intimidated. And during all those other times—the times of electronic flirting and teasing, intellect-filtering and friend-polling—well, it's FUN. This is exactly what technology should be.

Sneak Preview

While on the subject of additions to the Winnebiko, by the way, I should comment on the effects of visiting such tech-meccas as the Dayton Hamvention, COMDEX, and CES. This is the stuff that fuels the bike, and I suspect it has a lot to do with your motivations in this hobby as well. There's an adrenalin-like rush associated with wandering aisle after aisle of whiz-bang gizmology, especially when one recognizes that behind the sparkling exteriors of all those machines lie exquisite tools for talking, sharing, learning, scoring, playing, and whatever else it is people yearn to do with their free time. In my case, this all translates into wild dreams of the Winnebiko III...

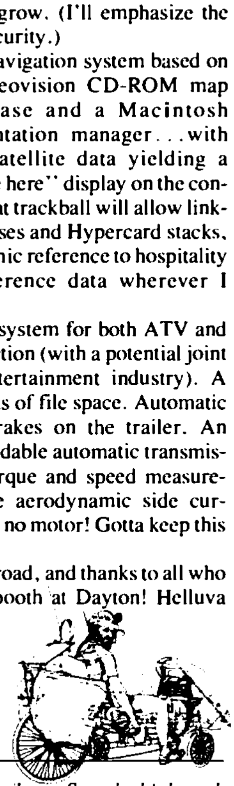
The security system will continue to grow, with a special function that detects a change of latitude and longitude (via GPS and LORAN) without an appropriate password. This will trigger packet beaconing on all available channels, giving a security alert along with precise position data and local recording (with optional transmission) of captured audio.

The bicycle-mobile ham station grows rapidly as we wander from hamfest to hamfest on the frenzied Computing Across America media tour. Bob Heil's 10-meter FM rig...an ATV transceiver on 450...an OSCAR station for Phase 3C...HF mobile operation from the PV-covered trailer with a thicket of Hustler verticals and handlebar remote control...I just hope KA8ZYW will be willing to carry all my clothes and camping gear as the Winnebiko's electronics continue to grow. (I'll emphasize the job security.)

A navigation system based on the Geovision CD-ROM map database and a Macintosh presentation manager...with live satellite data yielding a zoomable "you are here" display on the console. The under-seat trackball will allow linkage to other databases and Hypercard stacks, allowing easy graphic reference to hospitality and business-reference data wherever I happen to be.

An 8-mm video system for both ATV and on-the-road production (with a potential joint venture in the entertainment industry). A DAT recorder. Lots of file space. Automatic surge-hydraulic brakes on the trailer. An adaptive and overridable automatic transmission, driven by torque and speed measurements. Retractable aerodynamic side curtains. Etcetera. But no motor! Gotta keep this cycling life pure.

Cheers from the road, and thanks to all who wandered by our booth at Dayton! Helluva show... 73



To find out more about Steve's high tech nomadic adventures, you can request reprints of parts 1-5 from 73 editorial offices ($3 for the first one, $1.50 thereafter). Address correspondence and orders for Steve's book, Computing Across America, *to CAA, 1306 Ridgeway Ave., New Albany IN 47150.*

Care and Feeding of a PBBS

Timely tips for packet bulletin board users (Part II)

by David McLanahan WA1FHB

Disk Files

In addition to mail, the PBBSs offer disk files. What is listed as a message or bulletin and what is carried as a disk file depends on the taste of the system operator, but computer programs, and documents such as the *ARRL Gateway* and the *W5YI Report* are normally carried as disk files, as are reference materials such as system maps.

There are two types of PBBS in use, floppy-disk based and hard-disk based, and this reflects into the organization of the disk files. The floppy-based system will have between one and four "logical" drives and its directory is not usually divided further. **W** will give you this listing, although you can use normal CP/M file type specification to limit the list, i.e., **W *.HEX** or **W DX1?.ARL**, where **?** substitutes for any one character in the filename or extension, and * substitutes for any number of characters.

On a hard-disk-based board, however, the files are usually partitioned by the operator into categories—ARRL Bulletins, Network Information, Hardware Hints, etc. Each of these categories is given a letter, and that letter is added to the **W** to obtain that directory. Thus, on most systems, **WA** will list ARRL news, **WB** will show general bulletins, and so forth (see example). These category letters may vary slightly from board to board, but a plain W will give you a listing of them. (see Fig. 8.)

Having found a file of interest, enter **D filename.ext** to get it. (Don't include spaces between the name and the extension, even if they are shown in the directory.) The size of the file, of course, gives an indication of the time needed to send it. If the channel is busy, the download of a 12 kilobyte file will probably fail part way through, and there is no way to get the PBBS to "fill" with only the last third of the file.

There is an important detail on disk files: All of the PBBS's programs and files are held on those disks, and the operator has a switch to "hide" the files he doesn't want made public or downloaded. He may forget to hide a file, however, that should be hidden. If the PBBS user runs across a program with an extension (final three letters following the dot) of COM or EXE, such as **SOMENAME.COM**, he should NOT try to download it. It's an executable command program and, if downloaded, the PBBS may crash.

Uploads and Disk Space

PBBS operators usually welcome the uploading of pertinent files by users if it's done with forethought, but it's wise to check with the operator first. Before doing it, determine the size of the file to upload. Then log on and do a **W** command to check the amount of space available on each disk. Assuming that one of the disks has a LOT more space than the size of the file, do **U B:filename.ext** (where B: is the letter of the disk with much extra space) and send the file, ending it with a **^Z** (Control-Z), just as in ending a message. As with calls, either upper- or lower-case letters are OK. Note the admonition, in Part One, against using telephone modem error-checking protocols with packet.

The reason for special care on the disk space is that the PBBS has two disk files, usually hidden, that expand on their own during normal operation—**LOG.TNC** (the transaction record) and **MAIL.DAT** (the message file)—and if these are properly hidden, the user won't know which drive(s) they are on. If a user loads the disk containing the mail to within 2K of full, and a subsequent forward contains a 3K bulletin, the system will crash, likely destroying the mail file. Of course, the operator is watching for this, but he may be away (unattended automatic operation is legal) and unable to catch it before it's too late.

This space problem is most pressing with the floppy-based systems, which have 480 to 1000 kilobytes on-line space total for everything, but even 10 or 20 megabytes of hard disk can fill eventually. There are lots of files moving between boards now, and the 20 meg hard drives are going to fill even faster when the badly-needed 19.2 kilobaud GLB back-bones are in place within six months or a year.

Hidden Files

There are a number of files, used by the PBBS and usually hidden, that make dull reading if they are found: **LOG.TNC** (a slightly cryptic record of board activity), **CONFIG.TNC** (the file that contains all the "personalization" of that particular PBBS), and **FWD.TNC** (the file with all the forwarding instructions and calls used by the board). **USER.DAT** and **USER.BAK** contain coded information about the board's users. (This is the file that holds, for example, the name that goes with your call and the data on your last check-in.) **MAIL.DAT** and **MAIL.BAK** contain all the mail on the board, again in a very cryptic fashion. **MON.TNC** and **CALLS.TNC** contain lists of stations recently connected or heard. **HELP.TNC** and **INFO.TNC** are the files that the user gets doing the **H** and **I** commands, respectively.

Oops!

Once in a while, through the renaming of a file or a keyboard error, a user may find himself on the receiving end of a nearly interminable transmission. Perhaps he's started a download of a long, interesting BASIC program, but after seeing the first few lines he realizes that he already has it (possibly under a different name) from another board. Or, perhaps, on a board with a current message number of 5280 and 122 messages on-line, he fumble-fingers **L 10** instead of **LL 10** and spots the error when a listing of message 47, filed in 1942, graces the screen.

Once a long transmission has started, the PBBS will not respond to any abort command, nor will it even hear the **B** for goodbye. The user can just go for lunch or a siesta and let 'er perk, but that ties up both the PBBS

and the channel (not to mention his own packet station).

The best solution to this problem is just to disconnect from the PBBS. Once the TNC tells the PBBS that it hasn't anyone to talk to, it will blow out the text in its buffer and reset itself. The other alternative, just turning off the radio, will work also, but the PBBS will continue to retry transmission until it retries out, disconnects, and resets itself. This will take longer, again tying up both PBBS and channel.

Miscellaneous Commands

B, goodbye, (no modifiers) logs off the system politely. Disconnecting will also work, and if the user "goes away" quietly, (i.e., either no acknowledgements or no input) the board gives up after several minutes and resets itself.

J (no modifiers or arguments) gives a timed list of the stations most recently heard on channel and most recently connected to the PBBS. (see fig.9.)

P <call> gives the most recent digipeater path used by <call> to access the PBBS. Note that if <call> is an adjacent PBBS, the path you get may not be the path the board uses for forwarding. Also, if the subject station of the inquiry last connected using NET/ROM, the path shown will be only to the NET/ROM. If the nearest NET/ROM is adjacent to the PBBS, any station using it will show up as a "direct connection" in response to the P command.

```
cmd:c w1dsw-1 v k1bbg-1
cmd:*** CONNECTED to WB1DSW-1
Hello ?_Name, welcome to the All NEW WB1DSW xT PBBS & MailBox
from Herb in East Kingston, NH.  Last logged in at 1947 on 871213.
All Stations:  Al, W1ZHC - A Good Friend, is now a Silent Key.
Type H for Help, L to List new messages, NE to toggle expert status.
*** Please use the N command to enter your name.
*** Please use the NH command to enter the call of your home MailBox.
*** Please use the NZ command to enter your zip or postal code.
N1FBC de WB1DSW: at 1947z on 871213 B,C,D,H,I,J,K,L,M,N,P,R,S,T,U,V,W >
n Peg
*** Done.
*** Please use the NH command to enter the call of your home MailBox.
*** Please use the NZ command to enter your zip or postal code.
N1FBC de WB1DSW: at 1947z on 871213 B,C,D,H,I,J,K,L,M,N,P,R,S,T,U,V,W >
nh wa1fhb
*** Done.
*** Please use the NZ command to enter your zip or postal code.
N1FBC de WB1DSW: at 1947z on 871213 B,C,D,H,I,J,K,L,M,N,P,R,S,T,U,V,W
nz 03421
*** Done.
N1FBC de WB1DSW: at 1947z on 871213 B,C,D,H,I,J,K,L,M,N,P,R,S,T,U,V,W
ll 5
 Msg# TR  Size  To     From    @ BBS  Date       Title
 1264 BN   233 NEPRA  N1DKF          1212/2350 Al Sears, W1ZHC, SK
 1258 DN   433 ALL    WB1DSW         1212/2202 W1ZHC a good friend-a Silent Key
 1215 TN   452 NTB035 WB2FIX         1212/0311 LITTLETON/444
 1213 TN    94 N1NH   N1ALM          1212/0246 OCT 1 HOLLIS NH
 1165  N   236 KC1EO  KB1HE          1211/1635 Baleman's Curse
N1FBC de WB1DSW: at 1948z on 871213 B,C,D,H,I,J,K,L,M,N,P,R,S,T,U,V,W >
ne
*** Done.
1948z, 54 msgs on NEGate
w
Use W and directory ID:
WA AMSAT Info and files.
WB ARRL Bulletins via N1BZF).
WC Civil Defense and ARES Section.
WD DX Information of All Kinds.
WE Amateur Exams-VEC Testing Data.
WF Miscellaneous & General Files.
WG Fun Things to Read Area.
WH Various Hardware Mods and Fixes.
WM Various Network Maps & Lists.
WN Net/ROM info.
WP Program Exchange
WT Lots of Info on NTS/Formal Traffic System.
1948z, 54 msgs on NEGate
wh

EEMBBDS.INF      4k : KB20.121          2k

6k of 32678k used, 29268k free.

1949z, 54 msgs on NEGate
wm

050188B8.VB1     5k : CANADLST.BBB    2k : NEOSVB1.MAP      9k
10MOCTB7.MAP     2k   CENSUS.TXT      1k   NEOSVB2.MAP      3k
12-87MAP.OS      8k : DIGILIST.VB1    9k : NEO7VB1.MAP      5k
12MTRBBS.INF     2k . HFNET.STA       3k   NEO9.MAP         3k
70CMRPTR.TXT     2k : HFNET109.OCT    4k : NEO9VB3.MAP      2k
ALBERTA.MAP      7k : IFADDNY.VB1     2k : FBBBVS1.MAP      4k
BBB09831.MAP     2k : KIDNYTRN.TXT    2k : RAT807.MAP       2k
BBBMATRX.MGO     3k | LITCPIF.INF     2k : SKYWARN.FRQ      2k
C64DIRV1.NOV     4k | MEO3VB1.NAP     5k : UBA-PKT.DOC      3k

93k of 32678k used, 29280k free.

1950z, 54 msgs on NEGate>
b
*** DISCONNECTED
```

Figure 8. A sample first connect with a new board. After being greeted, the user entered her name (N), home PBBS (NH), and postal zip zone (NZ). She then listed the last five messages (LL5) and used (W) to get the list of file directories. After reading two of these directories with WH and WM, she signed off with the B command.

T (no modifiers or arguments) lets the user talk to the system operator if he or she is available. Unfortunately, the Xerox 820-I used by many PBBSs wasn't originally fitted with a bell, so unless one has been added, the operator has to notice the request on the local PBBS screen. If the operator does not respond within a minute, the PBBS times out, suggests to the user that he leave a message, and returns him to the normal command mode.

Forwarding

One of the cleverest parts of the **W0RLI** PBBS operation is the automatic message forwarding. If the system is working right, a user can place a message on his local PBBS for someone outside the immediate area, and it will automatically travel to the other user's local or home board.

No, PBBSs don't have a complete, continually-updated call book on line. Forwarding can be handled in two ways. One way is through the "local user." Each ham on packet announces to the operator of a local PBBS of his choice that he'd like to be considered a local user at that station. (This means an explicit message to the operator—a user just logging on and entering his name does not automatically become a local user.) Periodically that PBBS operator then sends "local user lists" to other boards in the area (and, of course, receives local user lists from them for inclusion in his forward file).

Now, this can work only within a reasonable area. For example, New England PBBSs cannot be expected to keep local user files for the West Coast or even for all of New England, particularly with all the new users coming on.

The second scheme—the @ ("at sign")

```
2246, fnb,109 msgs
j

- Connected -       -Heard, 145.01-     -Heard, 145.05-
N1FBC      2243      WA1TLN-1 2240       WA1ZYX     2235
W1FYR      2240      WA1FHB    2235      KA1BBG     2226
K1NEA      2235      KD1R-1    2216      K1MEA-10   1737
WA1B       2221      K1UGM     2215      W1FYR      1500
KD1R       2217      VRM       2158      WB1DSW-1   1459
VE1MOT     2207      N1I2      2152      N1BAC      1409
N1EMF      2113      N1CB      2133      WB1DNJ-1   0555
N1CF       2024      N1CB-15   2122      WB1DNJ     0549
KB1HE      1843      N1BZF     2011      KA1BBG-2   0549
WB1DNJ     1827      KB1HE     1627      KA1GOZ     0015
K1UGM      1622      WA2UMX    1536      N1API-5    1304
N1BAC      1245      WA1IDK    1524      N1AKS      1202
W1TN       1229      WA1NPL    1510      K1MEA-5    1120
WB1AJG     1146      W1FYR     1304      CON        1120
W1DA       1132      KA2VCS    1201      N1API-4    1018
2247, fnb,109 msgs
```

Figure 9. The "J" list—a log of recent activity noted by the PBBS.

notation—is rapidly becoming more widespread and puts the monkey on the back of the user. This scheme is a bit like knowing and using a telephone area code. When entering the address call, the user follows it with **@ W0RLI** or **@ KD1R**.

Specification of an @ <PBBS> on a message takes precedence, for that one message, over an entry in forward files. Thus, if N1FBC, a regular user at WA1FHB in Marlow, NH, is visiting in Syracuse, NY, (a suburb of Liverpool), a message addressed to **N1FBC @ N1BCK** will go to the N1BCK PBBS in Liverpool, regardless of forward file entries along the way that would normally send an N1FBC message to Marlow, NH.

The actual forwarding process depends on a personalized (for each PBBS) file usually titled FWD.TNC. This file starts off by sending parameter adjustment commands to the TNC. For example, as forwarding can be disruptive to other channel activity, most PBBS operators increase **DWAIT**, the time for the TNC to wait after the channel clears before it will transmit. This gives priority to keyboard users and to PBBSs that are dealing with keyboard users (as opposed to another PBBS that is forwarding).

The file then specifies the port (for a multiport system), the time span over which to forward, the call of the destination PBBS, and the digipeater string to use, followed by an addressee list for that PBBS. This list will have both calls of other PBBSs and users, as well as other types of addresses, such as NTSME (National Traffic Service, Maine) or MAPRA (Mt. Ascutney Packet Radio Association).

The time-span setting for forwarding is important to prevent QRM and spinning wheels. If a PBBS attempts to forward during a usually busy time (such as just after many of the users get out of work), the forwarding clutters the channel for them, making normal activity difficult. Into the bargain, the actual forward will likely fail because of collisions anyway, particularly if it's a long message or a multi-hop path.

Forwarding Delays

There are a number of causes for delay in the forwarding of messages. If a PBBS suspends forwarding between 1600 and 2359 local and a user drops in a message after his 15XX forward session, obviously nothing is going to happen until the forward after midnight, and that one's apt to be a bit of a zoo with all PBBSs trying to move the accumulation of eight busy hours.

The nature of the programming is that the PBBS must be clear (i.e., on-line with no user

logged on) for at least a part of its forwarding minute. It will then commence the routine and call the first of the PBBSs whose traffic it holds. Unless alternate paths are provided, a single busy from the called PBBS and the program is all done with that station for that forwarding period. Likewise, if the TNC retries out. Unless there are other instructions in the forward file, there will be only one try per PBBS. Thus, the destination PBBS being busy, even for only part of a minute, prevents the forward and delays the message another hour.

Now, using a forward file set up as mentioned earlier, and having had no luck with the distant station, the board will try the one next closer and, if it bombs out on that, one closer still. Obviously, the further a signal can go on one hop, the faster the service and the less QRM, but the shorter hops are more certain.

There's a more serious source of delay that can often account for a day or more. There is no authoritative list of PBBSs. They are increasing in number almost as rapidly as packet users. Thus, most operators do not try to include all PBBSs in their forward files. They include only the ones their users are apt to need.

If a user enters a message with a new @ W1ABC on a board that hasn't seen that call before, it'll just sit until the operator notices it, looks it up, and adjusts his forward file. Of course, if the PBBS is unknown to his operator the user may be out of luck, especially now that the zone numbers in ham calls no longer relate to station location. This is a problem especially around holidays and vacation time, when visitors from out of the area are attempting to communicate with home. If a user sends messages to distant points, it's helpful to put the destination town and state in the message title to assist the PBBS operators along the way.

To understand the reason for the creation of duplicates, let's look at the actual details of the forward. First, the forwarding station attempts a connect with the desired recipient. If the connect succeeds, the TNC gets (and reports to the computer) the connect message.

```
3780  F  1094 WB2BEJ KA2TOC N2AYY  861015 re # 3550
Via K1UGM: 5936 From KA2TOC Rcvd 861015/1838z, Sent 861015/1727z
Via WB1DSW: 309 From KA2TOC Rcvd 861015/1820z, Sent 861015/1834z
Via K1UGM: 5928 From KA2TOC Rcvd 861015/1535z, Sent 861015/1822z
Via WB1DSW: 300 From KA2TOC Rcvd 861015/1519z, Sent 861015/1533z
Via K1UGM: 5915 From KA2TOC Rcvd 861015/1235z, Sent 861015/1521z
Via WB1DSW: 290 From KA2TOC Rcvd 861015/1221z, Sent 861015/1255z
Via K1UGM: 5905 From KA2TOC Rcvd 861015/1035z, Sent 861015/1223z
Via WB1DSW: 282 From KA2TOC Rcvd 861015/1018z, Sent 861015/1033z
Via K1UGM: 5895 From KA2TOC Rcvd 861015/0934z, Sent 861015/1019z
Via WB1DSW: 275 From KA2TOC Rcvd 861015/0918z, Sent 861015/0932z
Via K1UGM: 5890 From KA2TOC Rcvd 861015/0833z, Sent 861015/0918z
Via WB1DSW: 270 From KA2TOC Rcvd 861015/0714z, Sent 861015/0831z
Via K1UGM: 5883 From KA2TOC Rcvd 861015/0634z, Sent 861018/0716z
Via WB1DSW: 266 From KA2TOC Rcvd 861015/0618z, Sent 861015/0633z
Via K1UGM: 5877 From KA2TOC Rcvd 861015/0530z, Sent 861015/0620z
At W1BDH :  3553 From KA2TOC Rcvd 861014/2212, Sent 861015/0126
msg # 3550 from "nocall" was actually me,
dan ka2toc
```

Figure 10. An example of message forwarding "ping-pong. K1UGM's forwarding file showed the path to the N2AYY PBBS as being through WB1DSW, while WB1DSW's file showed it through K1UGM. This one took place over a span of about 11 hours.

This is followed by the recipient's prompt line, ending with the "greater than," >, and a return. On seeing this, the forwarding PBBS sends **S W1XXX <return> message title <return>**, and waits. **Enter title for message** is received and ignored. The board waits for **Enter message...it will be number 1234.** When it sees that, it starts sending the message.

At the downstream end, the receiving PBBS starts stacking the incoming packets in a temporary storage buffer. Assuming the "acks" keep coming, the forwarding station continues to the end of the message and its all-important ^Z. Having sent that, it waits for a new command prompt to tell it that the forwarding of the message was completed successfully. In the meantime, the receiving station is scanning each packet for the ^Z. When it is found, the message goes from temporary to permanent storage and the command prompt is sent to the forwarding station.

Now, if Murphy, knowing its importance, makes off with that ^Z packet (and it still doesn't get through with retries), the forward fails, the temporary message (that might be complete or nearly so) is discarded, and the sending board tries again the next hour.

Suppose, however, the ^Z makes it, but the return command prompt gets lost (when an adjacent PBBS starts a file dump, for example). The receiving station has stored the message and is satisfied. The sender, though, still considers the forward as having failed, and will try again next hour. The next try may not follow the same path as the first, but should ultimately result in a duplicate at the receiving station.

PBBS operators try to be on their guard against this sort of thing, but duplicates can often be autoforwarded out within 10 to 20 minutes of their receipt, and some PBBS operators persist in the un-ham-like habits of eating, sleeping (or even going to work) without keeping an alert eye on the screen.

Ping-Pong

Putting together and maintaining a good forward file is quite a chore and every once in a while a PBBS operator will goof. Remember, too, the confusion resulting from the fact that the zone numbers in a call no longer reflect geographical location. Sometimes there is a situation where PBBS A thinks an addressee is to the west (beyond PBBS B), but PBBS B thinks the same addressee is to the east (beyond PBBS A). On a good night such a message can make the trip back and forth between A and B a dozen or more times!

Lost Messages

Sad to say, not all messages ever make it to their destination, and there are a lot of places that the wayward ones wind up. Of course, misaddressing (transposition of characters or confusion between zero and letter O, and between number 1 and letter I) are often caught by operators, but still take their toll. Lacking forwarding instructions, messages often languish on boards until the operator tires of seeing them and kills them (often after a month). Some messages are eliminated in error by operators cleaning up "dead wood" on the board.

Traffic Handling and NTS

The subject of message forwarding leads directly into formal traffic handling and the National Traffic Service. Now, I'm not a real "traffic person," but I believe that all hams have a moral obligation to honor the commitment made by our NTS brethren in this area. Many PBBSs are either operated by

Format for an NTS Message (Radiogram) on Packet

The third line from the top is the header line, which follows standard NTS practice. Following NR (number) is the sender's message number. Next is a space to give handling instructions (optional)—"R" stands for "routine". The handling instructions are not used in this message (see ARRL NTS literature for details.) Following that is the sender's call. The free-standing number is the word count of the text, not counting the signature. the town of origin and date of filing follow. Double carriage returns separate the sections of the message (equivalent to $\overline{\text{BT}}$ on CW or "Break" on voice). No parentheses or dashes are included in the telephone number.

```
Msg# TR  Size To    From   @ BBS  Date    Title
1668 TN   227 NTSIA KA1IFC        871119 NR 225 KA1IFC UTC Des Moines, Ia

NR 228 R KA1IFC 16 Baldwinville Ma Nov 18

Bob Kurtz
922 Boulder Ave
Des Moines Ia 50315

515 243 5493

Turkey day fast approaching x
Looking for a bird to
pluck and stuff x You
available query 88

-ed-
```

NTS people or have made arrangements with local NTS people to have the board covered and to see that NTS messages are either delivered or passed off to voice/CW nets for delivery.

Should your local board not have such coverage, do something! Don't let a message addressed to NTSNH or NTSOR sit on a board and gather dust. It's every ham's responsibility!

Caveats

Packet operators seem about equally divided between hams who've gotten on packet and computer operators who've gotten their ham licenses, and many of the latter are unfamiliar with the concept and regulation of "third-party traffic." Basically, third-party traffic is any message to or from anyone (amateur-licensed or not) who is not participating in a QSO. Of course, about 110% of all PBBS operation is third-party. Third-party traffic is specifically forbidden within many countries (such as the United Kingdom of Great Britain) and between ANY two countries, unless a third-party traffic treaty between those countries is in effect.

Because the United States, Canada, and Mexico specifically allow third-party traffic within their respective countries and there is a third-party treaty in effect between them, we tend to forget that this is the exception, not the norm. (Almost all of Europe is off limits, for example.) Using the PBBS network to try to forward any kind of meassage out of the country is a definite no-no, unless a third-party agreement exists.

> *"Many PBBSs . . . are operated by NTS (National Traffic Service) people . . ."*

Also be aware that the PBBS software is mature, and Hank Oredson WØRLI, the computer wizard who wrote it, and the others who maintain it try to keep the commands constant in the face of program improvement. The release of version 9.8 was widely heralded as the ultimate and perfect end of a long evolution. We are now using version 12.0 of the original code and C-language versions have been released. The WØRLI C code (which can be "ported" from one type computer to another) is now up to vers. 6.05, and several other programmers have had C-language PBBS code up and running at numerous sites for a long time. The PBBS programs will no doubt continue to evolve, causing minor differences in the command structure.

Kudos

On the subject of program writing and ongoing support, a bow is due in Hank's direction for both the excellence of the program and its documentation, and for the attention and care he gives both the program and the network that uses it. Without his efforts, packet would not be where it is today.

Dave Mc Lanahan WA1FHB has been on packet for several years and currently runs a PBBS using a call issued by a local CB store. He is presently studying for his FCC Novice license. He is also an optical engineer and physicist, a Certified Flight Instructor, and a nationally registered Emergency Medical Technician. He may be reached at PO Box 17, Marlow NH 03456, or @ WA1FHB.

WEATHERSATS

View On Video Processing

Dr. Ralph E. Taggart WB8DQT
602 S. Jefferson
Mason, MI 48854

SCAN CONVERTER SOFTWARE

By describing the basic software features of my *WSH** scan converter, I will answer quite a few questions at once. It is an appropriate time to treat the subject since the current release, Version 5.0, will be the last major upgrade of the software. Version 5.0 does just about anything one might want as the central element of a satellite receiving system.

An EPROM inside the converter contains the software. The software represents approximately 6K of pure machine code.

The preferred method of booting the software is the use of a front panel BOOT switch. When this switch is ON, the software will boot automatically when the power is applied to the host Color Computer. Even though the scan converter is connected to the system, the computer will come up in BASIC. Once the power is applied, the user can run tracking programs of any other application with the switch OFF. With the scan converter running, if the BOOT switch is turned OFF and the computer RESET switch is pressed, the system will drop out of the scan converter software and back into BASIC without altering any image data in memory. This lets the user run any other BASIC or machine language programs for playing with the image. Getting back into the scan converter program is a simple matter of simply turning the BOOT switch ON!

The software is all menu driven and requires only single keystrokes to activate features on individual menus. One use, for example, is the <ENTER> key. It is not required and the computer ignores keys that are not included on the menu options. When the software is called, a grayscale is passed to the display system and the Main Menu is available (see Menu 1).

Options 1-6 are all imaging modes for loading images, either directly from the station receiver, or from the audio tape deck. When one of these modes is selected, the Load Menu will appear (see Menu 2).

All the modes are listed in the left-hand column and the one the user selects will be indicated by a small token posted next to the selection. The image status column is used to provide an indication of the status of the load operation. When an image is being loaded, there is no effect on the image currently on display, since the new image will not be passed to the display until it is complete. This is a nice feature, since the user does not spend time staring at a display where a new image is gradually overwriting the old one! The <CLEAR> key can be used to exit a load operation at any time and return the user to the Main Menu.

AUTO WEFAX is the "standard" WEFAX mode and is completely automatic. Loading of a new picture only begins with detection of a start tone and all timing and phasing operations are automatically performed. As the system goes through the various start, phase, and load operations, the status will be posted with token indicators in the IMAGE STATUS column. The status indicator will indicate WAIT in the interval between WEFAX transmissions. In effect, this mode operates as a WEFAX bulletin board, where the monitor is always displaying the latest image. When I am not using the system for other modes, I keep it in the WEFAX mode where it gives me the latest WEFAX image with no attention on my part.

```
METSAT DISPLAY PROGRAM
VER. 5.0 ©1987
DR. RALPH E. TAGGART

—MAIN MENU—
1—AUTO WEFAX    6—120 LPM
2—QUAD WEFAX    7—DISPLAY
3—NOAA VIS      8—MED RES
4—NOAA IR       9—PHASE
5—240 LPM       0—FAX OUT
KEY IN SELECTION
```

Menu 1.

```
METSAT DISPLAY PROGRAM
VER. 5.0 ©1987
DR. RALPH E. TAGGART

—LOAD MENU—
AUTO WEFAX   IMAGE STATUS
NOAA VIS     WAIT
NOAA IR      START
240 LPM      PHASE
120 LPM      LOAD
USE <CLEAR> KEY TO EXIT...
```

Menu 2.

QUAD WEFAX is basically the option discussed last month. It functions like AUTO WEFAX in many respects except that it takes in four quad transmissions and merges them to reconstruct the image of the entire earth disk. The token posted next to AUTO WEFAX will contain a <Q>, to indicate that it is the quad mode which is operating while the LOAD indicator (status column), will include a number (1–4) to indicate which frame is currently being loaded. While AUTO WEFAX will continue to load frame after frame, until the user exits, QUAD WEFAX will return to the Main Menu when the earth disc is complete.

Variable Line Speeds

NOAA VIS and NOAA IR are routines to produce full-frame display of TIROS/NOAA visible and IR data respectively. When either mode is selected, the status column will indicate PHASE, followed by LOAD after phasing has been accomplished. Once 768 lines of image data have been loaded, the picture will be passed to the display and the system will return to the Main Menu.

```
METSAT DISPLAY PROGRAM
VER. 5.0 ©1987
DR. RALPH E. TAGGART

—MEDIUM RESOLUTION MENU—
1 2 3   SELECT DESIRED QUAD
4 5 6   USE <0> FOR MAIN
7 8 9   MENU
```

Menu 3.

```
METSAT DISPLAY PROGRAM
VER. 5.0 ©1987
DR. RALPH E. TAGGART

—HIGH RESOLUTION MENU—
1 2 3      SELECT       1 2 3
          QUAD—USE
4 5 6     <0> FOR       4 5 6
           MEDIUM
7 8 9    RESOLUTION     7 8 9
         < MR    HR >
```

Menu 4.

```
METSAT DISPLAY PROGRAM
VER. 5.0 ©1987
DR. RALPH E. TAGGART

—FAX MENU—
1—WEFAX RECORD/TRANSMIT
2—SMARTFAX (FULL FRAME)
3—SMARTFAX (HIGH RES)
4—SMARTCRT DISPLAY
5—ALDEN WEATHERCHART
KEY IN SELECTION (0 TO EXIT)...
```

Menu 5.

A 240 lpm scan rate can be used for manual display of WEFAX images but is intended primarily for advanced COSMOS display. The 120 lpm mode can be used for either side-by-side display of NOAA visible and IR display or for 120 lpm Soviet METEOR display. Neither of these routines incorporates automatic phasing since they are designed as general-purpose modes. Both will display the image and return to the Main Menu after 768 image lines have been loaded and the image can be phased using the Main Menu PHASE option.

When the system returns to the Main Menu from any of the imaging modes, the image in memory (and on display) is "frozen" and available for manipulation by other Main Menu options. DISPLAY is the simplest of these. It allows the user to recover the full-frame display of the image in memory if they have been playing with the Medium or High Resolution options.

The MED RES or Medium Resolution option is the user's gateway to the ultimate in image detail. Although the display is limited to 256 lines with 256 pixels/line and 16 grayscale values, the image in memory has 768 lines with 1024 pixels/line. If effect, the 256 x 256 display can be used as a "window" that can be used to "zoom" into the high resolution image in memory. When the MED RES option is selected, the Medium Resolution Menu is presented (see Menu 3).

This menu gives the user the opportunity to select any one of 9 overlapping quadrants of the full frame image. Any one of which will represents about ¼ of the entire image area and twice the resolution of the full-frame display. Selection of one of these quadrants (1-9) will result in the display of that quadrant and the posting of the High Resolution Menu (see Menu 4).

The selected Medium Resolution quad will be indicated on the display to the left, while the dis-

play to the right represents one of nine possible high resolution subsets of the Medium Resolution image currently displayed. Each time the user enters the number of one of these quads, the high resolution image will be displayed and the selected high resolution quad will be indicated on the left side of the menu.

To select another medium resolution quadrant, the user would use <0> to return to the Medium Resolution Menu. To freeze the current high resolution image, the <0> key would be used from the Medium Resolution Menu to exit to the Main Menu. Each high resolution image has twice the resolution of the medium resolution image and represents about ¼ of the area of the medium resolution display.

The Main Menu PHASE option is used to properly phase an image that has been loaded using the 240 or 120 lpm routines. Phasing is accomplished by moving the entire block of image data (380K) in to memory. Having the display oriented properly, all the other display options will continue to display the image in the same way.

The final Main Menu option is the FAX OUT routine and, if selected, will cause the Fax Menu to be displayed (see Menu 5).

simple FAX recorder described in the WEATHERSAT column for September and October of 1987. The full-frame options prints the entire picture while the high resolution option will print the last high resolution quadrant displayed from the High Resolution Menu. In effect, either option can be used to obtain a permanent fax printout in just a few minutes.

The SMARTCRT option does for CRT display what SMARTFAX does for FAX. The display terminal, to be described in two months, is much simpler than a dedicated CRT display, and it is useful for getting high quality photographic prints from the image in memory.

The ALDEN option provides base band video output to the Alden Weatherchart Fax recorder, reviewed in the October 1987 issue of *73 Magazine*. Although this recorder is designed strictly for 120 lpm weatherchart display, the computer can format the image in memory to provide for quality printing on this machine (see an example in the October 1987 WEATHERSAT column).

Test Routines

Although not listed on the Main Menu, two additional useful routines are buried in the software and accessible when occasionally needed. The first of these is a digital oscilloscope display which is enabled with the use of the period (<.>) key from the Main Menu. When activated, this routine clears the CoCo screen and displays an oscilloscope-like display of the video levels at the computer input. This display represents a 500 msec interval (one METEOR or NOAA line or two WEFAX lines) and lets the user do a precision job of setting video contrast for optimum display without the use of an external oscilloscope. Use of the <CLEAR> key will restore normal Main Menu display and the "scope" routine will not alter any image data in memory.

The second "buried" routine, activated by using the slashbar (</>) key from the Main Menu, will cause a grayscale to be passed to the video display. This is the same grayscale posted on power up and is useful for optimizing monitor brightness and contrast, as well as setting the proper f-stop for photographing the TV monitor display. Since this grayscale is generated by the computer, it does not alter image data in memory and the original image can be re-displayed using the Main Menu DISPLAY option.

Future Developments

At the start of this discussion, I noted that there would be no future upgrades of this particular software package. Some future developments are in store. A disc version of this same software package for the CoCo is presently being debugged. The program has all the features noted here with the addition of the ability to save and load images from disc. This will be a floppy-based approach for reasons of cost effectiveness. Since each image represents 380K of data, a hard disk would seem ideal for bulk storage. Unfortunately, a 10 meg hard disk will only hold about 26 pictures and will set the user back $400–500 or more for a CoCo compatible drive and controller. In contrast, a complete double sided floppy system will cost less than $200. Although each disk will store only one image, at less than $1 per disk, a $400 investment will let the user store 200 images! Actually, of course, there is no upper limit to the number of floppy disc images the user can file away. Regardless of the number in question, it is far cheaper to do it with floppies, not to mention the fact that a drive crash will not destroy the entire file of images.

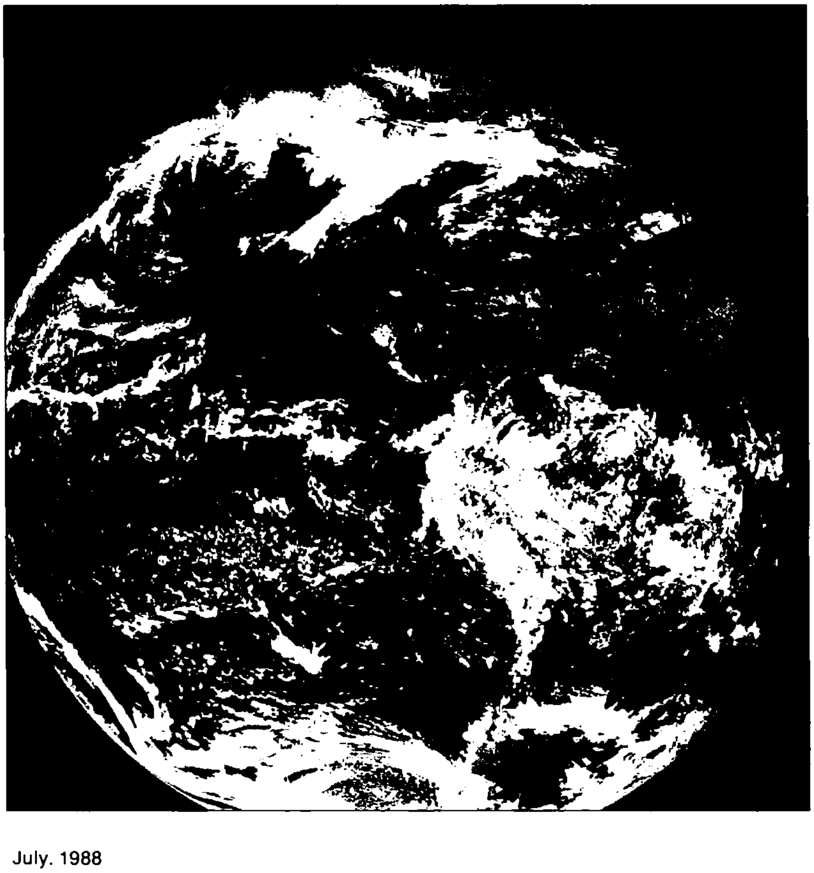
Picture of the Month

This marvelous image was pulled from my files, having originally been supplied by Bob Popham at NOAA. This image was obtained at 18:35Z on 11 February 1975. It represents the first image from SMS-2 (*S*ynchronous *M*eteorological *S*atellite), the prototype for our present GOES system. It was the pictures such as this, that spurred many of us to make the difficult transition from VHF to S-band (1691 MHz), something we take for granted today!

Fax Output

This menu provides a whole range of FAX output options to archive the pictures. It takes advantage of the fact that the image in the computer memory is essentially at full-resolution. Regardless of its original source, the WEFAX RECORD/TRANSMIT options outputs the image in memory in the WEFAX format where it can be recorded on tape or transmitted over a phone line or radio link. This provides a very nice method for storing pictures on a file tape since, on playback, the AUTO WEFAX option can be used for an automatic review of all recorded images. This option requires a very simple interface that will be described next month.

The SMARTFAX options all use the very



**References to* WSH *refer to the Third Edition of the* Weather Satellite Handbook, *available from WB8DQT at $15.00 per copy. Outside of the U.S., please include an additional $1.00 for postage.*

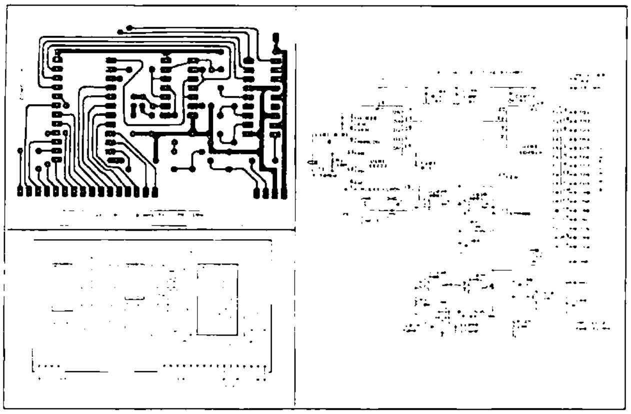


Figure 12. DTMF 1-16 decoder module.

Continued from page 29

Near the trace junction of U102 pins 3 and 5, cut ⅛" from the foil trace connection between this junction and U103 pin 1. Leave trace connection between U102 pins 3 and 5.

Prepare two, ⅜" small insulated wires. (#30 wire-wrap or equivalent) by stripping 1/16" insulation from each end. Carefully tin each end with solder. Tin each end of the foil traces with solder.

Connect one of the wires from U103 pin 1 trace to U104 pin 4. Leave IC socket pin hole open for later installation of IC socket. Connect the other insulated wire from U103 pin 23 trace to U102 pin 5. Again, leave the IC socket pin hole open for later installation of the IC socket.

Inspect adjacent wiring and circuit pads for accidental solder bridges. Remove excess solder.

Find on the foil pattern the location for C104 (near U102 pin 6 and ground). The solder pads for C104 are not on the circuit board. Place C104 flat on the circuit board. Connect C104 between U102 pin 6 (at R103 connection) and the adjacent ground foil.

Finally, refer to the foil layout (upper left) on Figure 10. Those who want to take advantage of the saturated collector of Q1 for relays, LEDs, etc. should connect a wire from that collector to the hole representing the fifth position from the lower left of the card edge (see dashed line).

In Closing

Hornblower is designed to be limited only by the imagination of the user. It's virtually impossible to detail all Hornblower applications. One word of caution: Do not put a high voltage across the Hornblower. Use low DC control voltage when using Hornblower for control of AC devices, or devices using DC voltages greater than Hornblower's source voltage. For example, do not use small circuit board mounted relays to switch 120 VAC circuits. Instead, mount a separate relay with suitable insulation specifications in a separate enclosure. See Figure 13A and 13B.

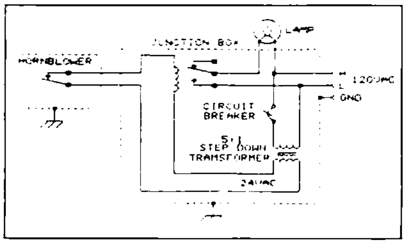


Figure 13A. 120 VAC wiring diagram.

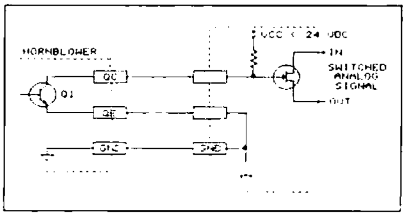


Figure 13B. Typical analog switch control circuit.

My prototype Hornblower has so far given me totally reliable service.

Hornblower's application development has been slow, but well worth it. Anyone fond of "warming up the iron" will find this a delightful project!

ABOVE AND BEYOND

VHF and UHF Operation

ON THE ROAD

Is it July already? Time sure flies when getting ready for the summer contest season. As of this writing, three of the ARRL Spring Sprints are now history (144, 220 and 432 MHz), and activity levels have been high. I decided to have some fun during the 220 Sprint by going portable with the IC-375A and one of the new Tonna 11-element yagis. Everything was stuffed into my Honda, along with a Mirage C1012 amplifier, keyer, portable masting, compass, clock and logbook.

The "scheme" (as they say in England) was to drive up to an area just northwest of Hazleton, Pennsylvania, find an appropriate high spot and operate from grid square FN 11. Activity from this grid has been sparse, with only one regular operator aside from the major VHF contests. I obtained topographic maps of the area and found several potential sites–all easily accessible from major roads.

The first mistake I made was leaving too late. Since the sprints run from 7-11 PM local time, it would have been very smart to arrive at the site by 6 PM or 6:30 PM. This in turn meant an easy set-up with lots of daylight left. A great plan–except I left my house at 6:20, over 90 minutes from my ultimate destination. Well, no problem there. I'd just make some contacts from the car.

Unauspicious Beginning

Twenty minutes into the trip, the IC-375A suddenly shut off completely–dead to the world. After pulling into a nearby truck stop, I removed the covers and did some poking around. No blown fuses to be seen anywhere! After some prodding, the rig did fire up, but with a severe RF feedback problem. Some more poking around somehow cured it and the IC-375A sprang back to life.

By this time, I'd gobbled up almost 20 minutes and almost scrubbed the mission (which, in retrospect, would have been smart) but set out on the Pennsylvania Turnpike for parts north. After driving the better part of an hour, I was but 15 miles from my destination when the bad news came via WA3AXV: Yes, FN 11 was on the air. Great. No point in continuing that way, and besides it was getting quite dark. A quick glance at the map and I detoured back towards the Pocono Mountains to try and find a site in FN 21. Not as rare a grid, but better than nothing!

After a lot more driving, I finally picked a roadside turnout atop a 2000+' plateau and set to work. It was now 8:45 PM, and I quickly erected 15 feet of masting, along with the Tonna yagi and a short 9913 pigtail. The Mirage C1012 was wired in the line and the IC-375A promptly went berserk due to some strange RF feedback loop. Extremely frustrating! The amplifier was shut down but the preamplifier proved useful as I proceeded to log 20 contacts in the next hour, with the spread over a half-dozen grid squares.

Mission Aborted

Around 10 PM, dark clouds rolled over and high winds kicked up, threatening to send the Tonna back to France via air mail! Discretion being the better part of valor, I lost no time in artfully kicking over the masting, completely tangling myself in the guy lines in the darkness. After wrestling with rope, coax and the stiff breeze, everything was stuffed into the Honda and the tailgate slammed shut. (I still haven't found my logbook!) The outside temperature had dropped to about 35 degrees, so out came the extra jacket and a thermos of hot chocolate.

Home never looked so good as I rolled in just after midnight, swearing up and down I'd "never do this again" as I always do after a grid trip. Want to know a secret? It really was fun seeing some new countryside and surprising everyone who thought I was home in FN20. Besides, I stopped in at one of these vacation homesites and boy, what a great deal I got on 2 acres with a lakefront view...

Beacon Update

The ARRL VHF-UHF Advisory Committee (VUAC) has recommended by a 15-1 vote, that the Membership Services Committee study the possibility of new segments for automatic beacon operation. This information was mentioned in the May issue of *QST*, and I have obtained information from the League regarding the proposal in detail.

Basically, there is a movement to shift automatic beacons on 2 meters and above, away from their present allocations, to avoid interference to EME operations. According to the League, many seasoned VHF/UHF weak signal operators have filed comments stating that such beacons also interfere with the National Calling Frequencies from 144 through 1296 MHz. I have not seen any of these comments other than those filed by Chip Angle N6CA. He asserts that beacons do interfere with moonbounce activity and in many cases run more power than is required for the propagation path.

The FCC-defined beacon subbands are (Part 97.87 (e): 144.05-144.06 MHz, 220.05-220.06 MHz, 222.05-222.06 MHz, and 432.07-432.08 MHz. No FCC regulations exist at this time to govern beacons above 450 MHz. The ARRL VUAC proposal would shift beacons according to the following table:

144.275 to 144.300 MHz
220.275 to 220.300 MHz
432.300 to 432.400 MHz
902.300 to 902.400 MHz
1296.300 to 1296.400 MHz
2304.300 to 2304.400 MHz
3456.300 to 3456.400 MHz
5760.300 to 5760.400 MHz
10368.300 to 10368.400 MHz

The Membership Services Committee has been asked to present its findings to the ARRL Board or Executive Committee in July. MSC has also been asked to consider whether or not to petition the FCC to incorporate the changes above 450 MHz in Part 97. (At the moment, no such regulations govern beacons above 450 MHz.)

How do you, the reader, feel about this proposal? I sensed considerable objections at the April meeting of the Mt. Airy VHF Radio Club, many of whose members are active on microwave frequencies and have built and operate beacons. The consensus was that what might be a "West Coast" problem wouldn't necessarily be so in this part of the country. Indeed, I've yet to hear any complaints about beacon operation with regard to EME and calling frequencies (which, for the record, are in every case at least 20 kHz higher than the upper beacon subband limit).

Most operators felt that things were best left alone, especially on 902 MHz and above. In many cases, having the beacon close to the calling frequency allows a quick check of propagation without having to jump up the band 300 or so kHz. Also, operators use beacons on 902, 1296 and 2304 to resolve their actual operating frequency...I certainly do on 1296! Another point to consider: It makes sense to have the beacons situated as low as possible within each band as the MUF creeps higher during enhanced conditions.

Whatever your opinion, please convey them to John Lindholm W1XX who heads the Membership Services Committee! Or, contact the local ARRL official (preferably Division Director or Vice-Director) as soon as possible. While changes might be necessary to accomodate 2 meter EME users, I'm not totally convinced of any problem on 220 and 432, and see no good reason to make any changes at 902 and above. The activity levels don't support such a change–at least not in this geographic area.

Coming Attractions

Next month, I'll have a full report on grid expeditions for the 902, 1296 and 2304 MHz Sprints, and hopefully they'll be somewhat more successful than 220 was! Also, a sneak preview of the new Yaesu FT-790R 70cm portable (companion to the FT-690R and FT-290R 6 and 2 meter units), just released by Yaesu in time for Dayton. I still maintain these are the best VHF/UHF radio values around...a portable, mobile and base station all in one package at an excellent price.

Perhaps I'll be fortunate enough to work some readers as I go on a few DXpeditions this summer. The CQ WorldWide VHF WPX on July 16-17 will see me tripping through FN14 and FN24 in upstate New York, working 50 through 2304 MHz. The August UHF Contest will see a trip to either FN23 or FN34 for microwave operation, and it should be fun.

Whatever seems intriguing... now's the time to plan it, and get that new antenna up... install that new transverter... build that new preamplifier... or go grid-hopping. Remember, all of the summer contests offer seperate competition categories for QRP Portable stations, and at least two offer trophies for the effort (June VHF QSO Party and July CQ VHF WPX). Why not give it try? See you in August...Above and Beyond.

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

Eleven Years of RTTY Loop!

This column is now entering its *twelfth year* of publication. I thank each loyal reader for allowing me to present the news of radio teletype and digital communications in what has hopefully been an informative and entertaining blend.

This coming year's Loop will see added topics covered, such as an increasing emphasis on the world of digital communications other than five-level Baudot. Many readers have expressed an interest in learning more about basic computing—this column will soon cover some of the *basics* of this.

PClone RTTY

A few months ago, I mentioned radioteletype for the IBM™ PC and PClone series, and hinted that an old friend had produced a new gem worthy of appreciation. This friend is Clay Abrams K6AEP, and the gem is a likely successor to the CoCo NRTTYCW program, a new work co-authored with Michael Meeks WA4VEF called "CPR." Running (C)W, (P)acket, and (R)TTY, this reasonably priced software may be just the ticket for the amateur wishing to get onto radioteletype with a PClone and a "smart" interface.

The choice for the amateur wishing to get onto RTTY with a computer is a simple one: software or hardware? Software may be inexpensive, but often lacks sophistication and flexi- bility.

Hardware solutions are more expensive—a good smart interface such as the one used here is about $300. That buys a box, however, that can bring signals out of the mud, and allows in- credible flexibility and features, often with the assistance of a front-end program such as CPR. All serious RTTYers should try to set the money aside for a smart interface.

CPR

CPR is set up to use a variety of interfaces, with information provided for the AEA PK-232, Kantronics UTU, KAM and packet controller, and Tono Theta 777. Data is given for how these interfaces are configured.

Documentation is a 23-page manual on the disk, printed out with the "PRINT CPR.PRT" command. The file is full of little formatting codes that, on an Epson compatible printer, produce indents, bold face, underlining and the like. Hopefully, future editions of this manual will appear in straight ASCII without these codes. This way, they may be printed by other printers without problems, as well as viewed on the screen with TYPE or LIST commands. Formatting aside, the manual is thorough and covers the program fully, as well as instructions on customizing the files used to interface with the RTTY modem.

Clay even supplies a public domain editor, FRED, on disk, which is less clunky than EDLIN. This is useful for those who don't have a word processor they feel comfortable running in ASCII (non-document) mode.

CPR can operate in a variety of modes to best suit particular operating habits. A dumb terminal mode is provided for the classic "glass Teletype" look, as well as a more useful split screen. Since the program operates through a multi-mode interface, all digital modes are normally supported, including RTTY, packet, and AMTOR, along with CW.

Transmit or receive buffers are supported, which may be up to 640K long! Not only may data be stored, but one can look at what's in the buffer while it's still receiving data. Single function keys can enable the sending of ten station buffers, each of which can hold twenty characters. This is useful for calls, IDs, and the like. If that's not enough, there are ten variable length (up to 64K) buffers that may be loaded off disk and transmitted directly.

The user has nineteen definable function keys at his disposal. He may also specify the colors used in parts of the program, to help him identify various data fields. There's even a series of help windows that can "pop up" during split screen operation to describe all functions of the program.

Clay took a drubbing with the CoCo program as copies were circulated around to friends and neighbors. This friendly sharing was one of the reasons he was reluctant to re-enter the amateur software market. With CPR, he has put at least one fly—a very large fly—in the ointment. The registered user's name is hard coded into the program and appears on the screen when the program is booted. My name on my registered copy is well hidden—I was unable to find where he had stashed it. Who wants to advertise they're illegally sharing their ware?

"All serious RTTYers should try to set the money aside for a smart interface."

The program is available from Clay for $30 (US or CDN), with $3 for shipping and handling for foreign orders. Drop him a note at 1758 Comstock Lane, San Jose, CA 95124. Be sure to mention RTTY Loop.

Looking Ahead...

Now, it's the readers' turn—what do you want to see? There's a plethora of topics. I could start at the bit/byte level, including such wonderful things as hexadecimal arithmetic and what's a 150 ns chip, anyway? There's also plenty to say about interfacing and RS-232. How about a discussion on why TV pictures don't look as good as computer monitor images? The range is indeed broad, so here's the proposal: I will set aside an area—called "Byte Bin," or "Computer Corner"—to address these topics. Drop a card or E-mail to the addresses listed below with questions pertaining to this. A reader should do this also if he feels he can clarify a complex and oft-touched upon topic, so that all the readers—me included—can benefit from it.

Looking Back...

Many readers continue to ask about previous columns. An updated index of RTTY Loop covering the first eleven years is available. Simply send a self-addressed, stamped envelope with postage for two ounces and specify the RTTY Loop Index. Also still available is the CoCo RTTY program from the January 1988 column. I'll send that along for a disk, $2, and a self-addressed, stamped mailer.

PClone owners should also keep in touch. I have a line on some of the PD RTTY programs from bulletin boards. For the same arrangement as above, I'll send along interesting PC files as they appear.

Electronic mail is always welcome, either via CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). Please be patient for the reply. Send USPS mail at the above address, always enclosing a SASE.

Next month, a fancy commercial program to look at, and perhaps a peek at the National Bureau of Standards In your backyard. Interested? Don't miss the August RTTY Loop!

ATV

Ham Television

Mike Stone WB0OCD
P.O. Box H
Lowden, Iowa 52255

Can ATV be digitized? Of course it can. Video digitizers are available in the marketplace for just about any home personal computer at a reasonable price. Some computers like the IBM PC (and Clones) have several to choose from at different resolution values. Bill Brown WB8ELK of Findlay, Ohio, and his brother Jeff have been enjoying videotaping Fast Scan TV pictures and then running the taped image through a video digitizer for the Radio Shack TRS80 Color Computer to produce excellent hard copy printouts! It is fun to do this and capture that memorable long distance Ham-TV QSO for your paper scrapbook.

The television signal itself can be digitized to some 56K with a good displayed image. Unfortunately, this type of gear is too costly for the common ATV shack. Bruce Brown WA9GVK of the Metrovision ATV Club in the Washington, DC, area can give details on what tests the Navy has conducted on Digital TV. In Japan, there are now TV sets available that digitize the TV signal itself. This enables a viewer to watch one program while keeping track of one or two other channels at the same time.

Slow Scan TV of course has been digitized for many years. The days of burning images on P-7 tubes are long gone, and quality images sent on SSTV in color now rival real time TV. Clay Abrams K6AEP in San Jose, CA is already experimenting with a high-resolution digitized system using something much different than CGA or EGA monitor display standards. While the ROBOT 1200C continues to reign the SSTV world with the best pictures for the money, computers and their software are quickly catching up.

ATV in Space

Interest in narrowband TV techniques has renewed here in the USA again, and a few brave Ham-TV souls are playing with reduced bandwidth methods that might end up even on a future Space Shuttle. The present NASA ATV proposal, written by N9AB, under the auspices of the Motorola ARC, does not allow the majority of Ham-TV Amateurs here in the USA, let alone the world, to work any future Shuttle Flight on the TV mode. Henry B. Ruh KB9FO of the Chicago PATC Group now has an alternative NASA ATV proposal before NASA and League Officials, which describes a narrower bandwidth TV mode that looks more promising than the Motorola proposal. Henry's entire proposal was printed in the March/April 1988 issue of *The SPEC-COM Journal*. See sidebar for a summary of the proposal. Comments have looked encouraging from NASA officials and even NBC Science Reporter Roy Neal K6DUE commented in a return acknowledgement letter to KB9FO on March 24th . . . "I think you have a major plus in your thinking. It is something many hams can handle. You might keep in mind that the great majority of hams are not interested in ATV . . . But NASA is, and the future of ATV in manned space may be very dramatic. Keep me posted."

Skeleton-Slot Antenna

Included in this month's ATV column is a drawing of a Skeleton Slot dual-beam antenna cut for ATV by W4LUB. It can be mounted vertically or horizontally. Note the 7-inch dimension setting in Fig. 1 between elements and construction all out of PVC pipe for the support mast. Hooking into the beam couldn't be any simpler as shown in Fig. 4. Element lengths for the 10 elements are also depicted. The reflector is made from ½" hard drawn copper tubing with sweated elbows. This design was published several years ago in "A5" or SPEC-COM and has been built by many FSTV UHF enthusiasts around the country. The system has good proven gain and sufficient band width to handle the wideband ATV signals. The simple design should not be substituted however, for the better, longer, higher gain DX arrays. Thanks W4LUB and WB4AOH for the submitted information.

Those of you who have the popular Radio Shack TRS80 Color Computer should send us an SASE for our latest Amateur Radio Software catalog. The new revised May catalog has a lot of changes. The biggest change has come in the popular COCORADIO "interfaceless" disk package. Version 8.0 is out and everything–I mean *everything* (SSTV, FAX and all)—is now on just one single diskl ($49.95). Free updates to those who are registered users ($3.00 asked for return mailing). Return only your main operating disk, not the SSTV and FAX picture disks.

ATV Special Events

As I typed this column on Easter Sunday April 3rd, our local ATV gang had a ball this evening. We had our regular FSTV NET in conjunction with a bigger FM NET on 146.28/88 MHz. At about 9 PM, Matt N0GIK who works at KWQC-TV Channel 6 (NBC) in Davenport, broke in on one of our 10 computer screen 910 MHz link channels and said, "Hey fellas watch my special show from the Newscenter. The show begins at 10 PM!"

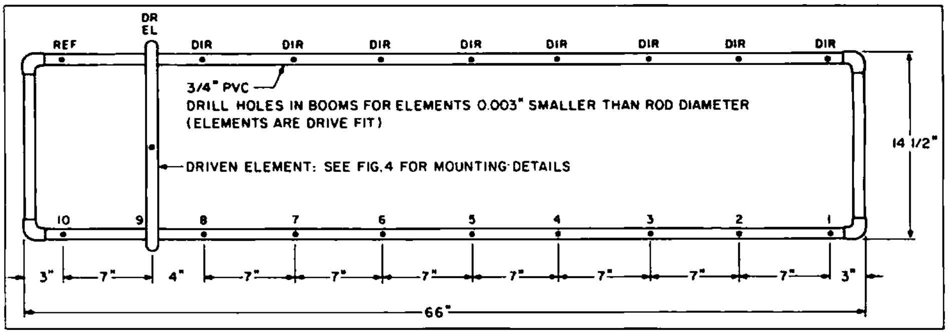


Figure 1. Boom dimensions for the Skeleton-Slot Dual Beam antenna.

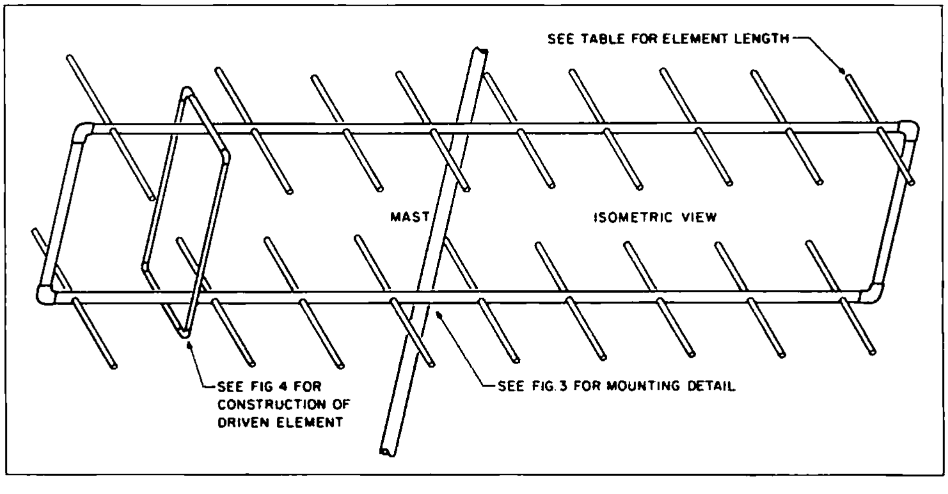
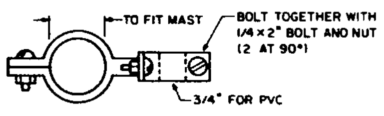


Figure 2. Diagram of Skeleton-Slot Dual Beam antenna.

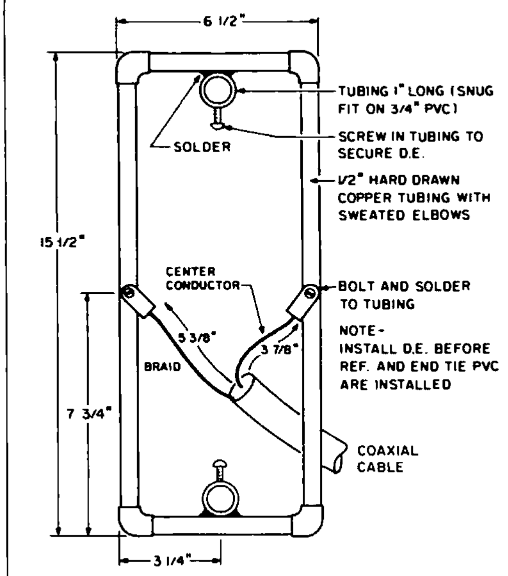


ELEMENT LENGTH	
EL #	LENGTH (INCHES)
1	10 1/4
2	10 1/2
3	10 5/8
4	10 3/4
5	10 7/8
6	11
7	11 1/8
8	11 1/4
9	SEE FIG.4
10	13 1/2

ELEMENTS MADE FROM 36" LONG STAINLESS STEEL WELDING ROD APPROX. 3/16" DIAMETER

(COST: $4 FROM MODERN WELDING)

Figure 3. This figure shows the mast/beam connector. Table gives element lengths.



COST OF MATERIAL FOR BEAM IS LESS THAN $15.00

Figure 4. Driven element for the Skeleton-Slot Dual Beam antenna.

He hooked up to the control room and camera feed, and we got to see all the activity behind the scenes (anchors off camera, weatherman standing in front of chromakeyed background, etc.). All commercials and other station facility IDs were edited out, so we only saw legal material just like anyone would see from a remote camera. It was really neat, and some of us taped the event.

It is important that all ATV Groups or Clubs plan some sort of special event a couple times per year just to keep interest up. April 16th we had our 3rd annual ATV T-HUNT. Our contest is a video TV image signal hunt only, with no RF sniffers allowed, and the winner in each year's contest automatically becomes the hidden rabbit in the next year's event. Those who live in "dead" or inactive ATV areas with amateurs who have gear sitting around have only yourselves to blame for snowy pictures on your screens night after night. With Field Day approaching, what better way to promote the ATV to other hams than to include FSTV and SSTV in the club station?

In addition, building an ATV remote transmitter system (not necessarily a repeater) is a great way to boost activity! We have written dozens of articles about the benefits and pitfalls of these systems in the past. If you or a group of Amateurs is seriously interested in building up such a system or wants to find out how to build an ATV Repeater, I would suggest that spending $10 and obtaining Ralph Wilson's newest reprint booklet #101, *ATV Repeaters*. He also has another new booklet out entitled *Microwave Guide* by Mike Veldman WD0CTA #112 (same price). Ralph's address is ESF Copy Services, 4011 Clearview Drive in Cedar Falls, Iowa 50613.

Finally, USATVS Member Ray Stevens W2BYO writes that he is willing to buy one of the neat little Mitsubishi Visitel Phoneline SSTV Converters if others will and get on 20 meters to exchange the quick 5.5 second B/W pictures. The converters were mentioned in the February and March/April issues of *SPEC-COM* and the January 1988 New Product listing in *73 Magazine*. Contact Ray at P.O. Box 235 in Wellsville, NY 14895.

Well that is about it this month Ham-TV fans! I hear that there has been a drop recently in the number of votes for the ATV column in *73* on the Reader Service cards. Please, let's keep this unique and important momentum going for a National ATV column each month in *73*! . . . WB0QCD

ATV in Space

[*The following is a summary of* Proposal and Issues for Amateur Television on Future Space Missions to Allow Worldwide Participation *by Henry Ruh KB9FO. Forward comments to him at 540 Oakton Street, Des Plaines, IL 60018.*]

Objectives

Amateur television on future space missions should foster international interest and participation well beyond the six thousand hams who now enjoy this mode. Reducing the technical requirements and equipment costs for ATV participation would significantly increase the pool of ATV users. Increased international participation would promote technical advancement as well as international goodwill on a greater scale than possible now.

Current Proposals

Several groups, including a Motorola-sponsored ATV club, have proposed methods for operating ATV from the Space Shuttle and the Space Station. These proposals have various advantages, but their shortcomings should be addressed, as well.

In particular, the Motorola proposal concludes that 439.25 MHz would serve as the best frequency of operation. A full bandwidth ATV system for space operation would require 1500 watts PEP output into a 17 dBi gain antenna. This power requirement would immediately limit the number of participants largely due to amplifier cost. Further, assuming 30% transmitter efficiency, 1500W PEP output would require 4500W input, a power level not allowed by current FCC regulations. The proposed 439.25 MHz frequency would also be subject to interference from FM repeaters, and many countries with only 10 MHz allocation on 70cm (430-440 MHz) would not be able to participate, because the signals would be partially out of band. The only choice for international space ATV communications that is subject to the least interference is 434 MHz. The Motorola proposal does not address ATV transmissions on higher frequency bands such as 902 or 1280 MHz.

By specifying only fully bandwidth NTSC-format video transmissions, the Motorola proposal excludes two thirds of the potential participants, since most other countries use PAL and SECAM video signals. These systems are not compatible due to different scan rates and color subcarrier frequencies. Monochrome transmissions would allow all systems to receive images with unmodified or slightly modified monitors.

Narrowband Techniques

Considering the bandwidth limitations imposed by many countries on 70cm, narrowband TV (NBTV) techniques should be considered. NBTV would require only 2 to 2.5 MHz bandwidth, which is suitable for full motion black and white pictures. Further, NBTV provides an improved noise level, diminishing effective radiated power requirements by 3 to 6 dB.

FM modulation of the video carrier would permit use of readily available FM transceivers to recover the audio information. Users can also generate their own audio subcarrier locally with a low power oscillator for whatever frequency is required for proper reception. This system is fully compatible between NBTV and full bandwidth systems used internationally, whereas the Motorola proposal falls considerably short of the stated objectives.

Number 28 on your Feedback card

AERIAL VIEW

Antenna News

Arliss Thompson W7XU
7314 SW 28th Ave.
Portland OR 97219

INSTALLING BEAM ANTENNAS

Fall is on the way, and the antenna raising season is here. Even now new towers are poking their heads above the skyline, waiting for their owners to adorn them with arrays of aluminum. Unfortunately, more than a few hams don't know how to move their new beam (which currently occupies most of the back yard) from ground level to the top of the tower. This month's column offers some ideas on how to safely install even large HF beams atop towers.

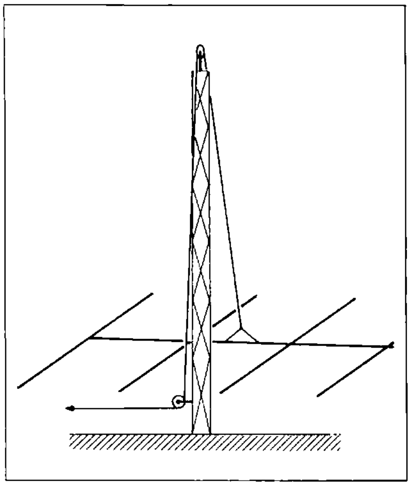


Figure 1. Raising assembled antenna on free-standing tower.

Safety and Planning

Since some readers already have a tower in place, I assume they have a quality safety belt and are aware of basic safety procedures related to climbing towers. I feel compelled to remind them, however, of the need to be alert for power lines and other hazards that are a potential threat to not only antenna and tower, but also to life. In fact, it's a good idea to have one person whose only job is to stand at the side of the operation and be alert for accidents that are about to happen. Also, before ever leaving the ground, the climber and ground crew should have a firm plan in mind. In order to minimize confusion, only the ground crew leader should be conversing with the climber(s) on the tower. Whoever is on the tower should have the ultimate say in what is to be done, since they are in the position of greatest risk.

If the reader has never erected a tower nor mounted a beam atop one, I suggest participating in an antenna raising parties for other hams. Besides providing what will probably be some needed muscle, it's good training.

With those thoughts in mind, it's time for the antenna raising.

Going Up

Of course, using a "cherry picker" is the way to fly, but few hams have such resources. What are the realistic alternatives?

Hams who own a free-standing or crank-up tower definitely have it over those with a guyed tower. Those with the former arrangement can assemble their antenna on the ground, and pull it into position with the aid of a gin pole or pulley temporarily mounted at the top of the tower (Figure 1). Attach the rope to the antenna's center of gravity, which should also be the point where the boom attaches to the mast. Doing so will minimize the tendency of the antenna to tip to one end or the other, although it may still tend to rotate vertically about the axis of the boom. If additional control of the antenna proves necessary (due to wind, perhaps), lightweight lines can be secured to the boom as shown in Figure 2. Be sure that those ropes can be removed once the beam is in place. Also, make sure that the rope harness for raising the antenna doesn't interfere with the mounting of the boom to the mast once the antenna is in place.

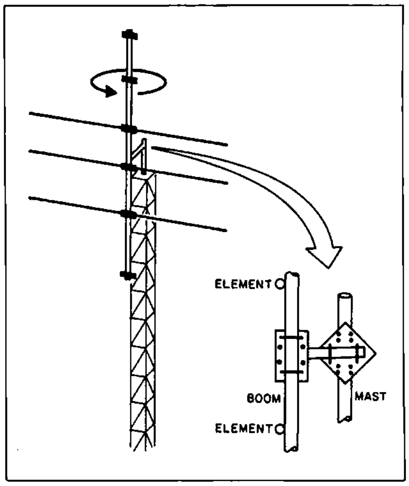


Figure 3. Assembling antenna with PVRC mount.

Antenna assemblers with small backyards may not be able to lay out the fully assembled antenna on the ground prior to erection. In that event, raise the antenna in sections and complete assembly at the top of the tower. This process is shown in Figures 2 and 3. Figure 2 is similar to Figure 1, except that in Figure 2, only half of the antenna is being hoisted at any given time.

> **"Before ever leaving the ground, the climber and ground crew should have a firm plan in mind."**

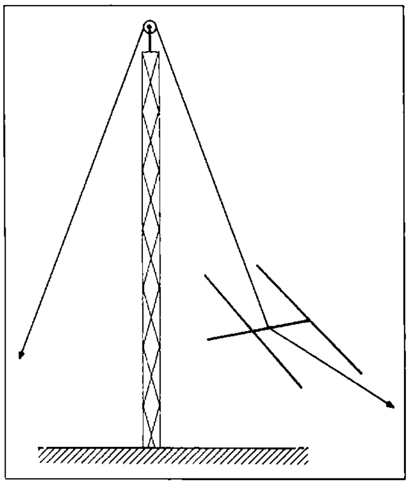


Figure 2. Raising antenna sections to be assembled on tower.

If lack of space prevents ground-level assembly of even half of the antenna, I suggest using the method shown in Figure 3. This uses the Potomac Valley Radio Club (PVRC) mount, described in *QST* (March 1982, pp. 28–29) and in recent editions of the *ARRL Handbook*. Basically, the mount permits the boom to rotate 360 degrees in two planes, thereby allowing the boom to be brought alongside the tower for mounting the elements. Using the PVRC mount, it's possible to assemble large antennas on the tower even if obstacles on the ground preclude assembly of more than one element at a time there.

Trouble with Guys

Free-standing towers certainly are convenient. Unfortunately, they are also considerably more expensive than their guyed equivalents, so it's not surprising that many hams find themselves with guyed towers. Depending on the circumstances, positioning any sort of beam atop a guyed tower is often difficult, particularly when attempting to use the methods shown in Figures 1 and 2. I have used the latter method to successfully maneuver a large tribander past several sets of guys and into position at the top of a 70-foot tower. If there isn't good coordination among the workers involved, however, it's all too easy to bend elements or otherwise damage the antenna.

Temporary repositioning of the obstructing guy wires is one solution to this problem, although finding a suitable anchor point may be difficult, or at least inconvenient. Offsetting the uppermost guy wire while installing the antenna, or allowing it to go slack after temporarily attaching an additional guy at a somewhat lower position on the tower will, however, allow the use of the PVRC mount on guyed towers. Following that route permits the installation even on large beams on guyed towers when ground space is at a premium.

Another method suitable for use on guyed towers is the so-

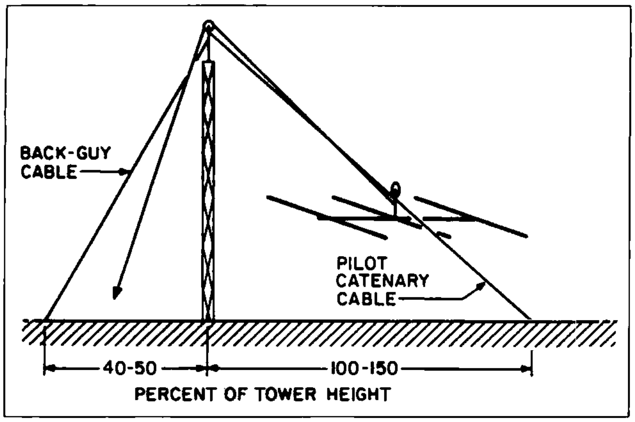


Figure 4. Pilot-catenary back-guy method of erecting antennas.

called pilot-catenary back-guy (PCBG) system, shown in Figure 4. With this method, the antenna rides into position while being suspended from a pulley that rides on the pilot catenary cable. A back guy cable, 180 degrees opposite the pilot catenary, eases stress on the tower and mast. This method requires the top set of guys to be temporarily dropped to avoid entanglement with the beam as it is being raised into position. The back guy and catenary, however, hold the tower very steady during the short time that it takes to raise the beam. When using this method it will be necessary to have a clear space on the ground large enough for the fully assembled antenna. The erector will also need sufficient room to anchor the back guy and pilot catenary cables. Typically, a horizontal distance equal to 150 to 200 percent of the tower height is required. Additional details on this method of installing antennas are available in Young's article on the subject in *The ARRL Antenna Compendium*, Vol. I, pp. 144–145.

The tram system, and variations thereof, allows a beam antenna to be raised on a guyed tower without requiring even temporary changes in the guy wires. The basic arrangement is shown in Figure 5. A pipe approximately ten feet long is secured in a horizontal position at the apex of the tower. (One can use two by fours or other lumber, if sufficiently stout, in place of the pipe). Parallel ropes run from either end of the pipe (or 2 x 4) to temporary anchors at ground level. The ropes are situated so that they lie above the highest set of guys. The antenna is then placed on the ropes and pulled into position by sliding it along the ropes to the top of the tower.

The ropes upon which the antenna rides should be free of knots to avoid having the beam snagging during its ride upward. Attach a light line to the boom for better ground crew control of the antenna as it is being pulled up the rope track. Be sure this line is removable once the antenna is in the air. Alternatively, erectors can add a third rope or cable to serve as a guide line, with some temporary connections between the boom and guide line to keep the beam aligned with the track.

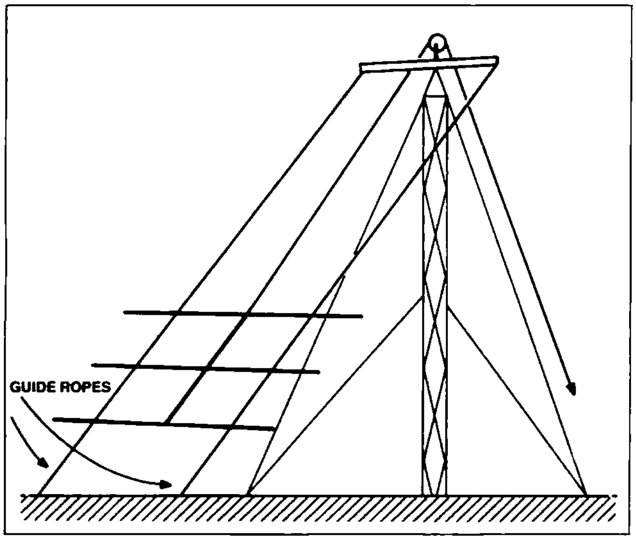


Figure 5. "Tram" method for installing beam on a guyed tower.

Walking up Masts

Attempting to "walk up" masts and hinged towers is a situation that can arise at any time of the year but is especially likely to occur during outings such as Field Day when there's a big need for temporary antenna supports. It often happens that one member of the Field Day expedition volunteers a small tribander that has been sitting in his garage, and two other participants bring a mast and rotor. Since it's not possible to climb the mast, even if it is well-guyed, the obvious way to raise the antenna is to attach it and the rotor to the top of the mast and then walk the assembly into position.

If the group is lucky, or better yet, has given the process some thought, this may work well. Unfortunately, what sometimes happens is that the realities of physics overwhelm the capabilities of the Field Day party, and the entire works come crashing to the ground.

A Brief Example

Figure 6 shows the forces related to walking up a mast or hinged tower. (F) is the force exerted at right angles to the tower in an effort to raise it to a vertical position. (H) is the height above ground at which that force is applied. The mast weighs (M) lbs and is (L) feet long. The rotor and antenna together weigh (W) lbs. It's assumed that the mast is of constant diameter and that the antenna is located immediately above the rotor. The maximum amount of force that must be applied to raise this combination to a vertical position occurs when the mast is at a 45 degree angle from the ground. At that point the force will be approximately:

$$F = L(M + 2W) \div 4H$$

Let's work through an example. Assume the mast is 40 feet long and weighs 60 pounds. The antenna and rotor together weigh 40 pounds. In other words, L=40, M=60 and W=40. Let's also assume that due to the heights and the lengths of human arms, the builder will apply a force centered at 6 feet above ground; i.e., H = 6.

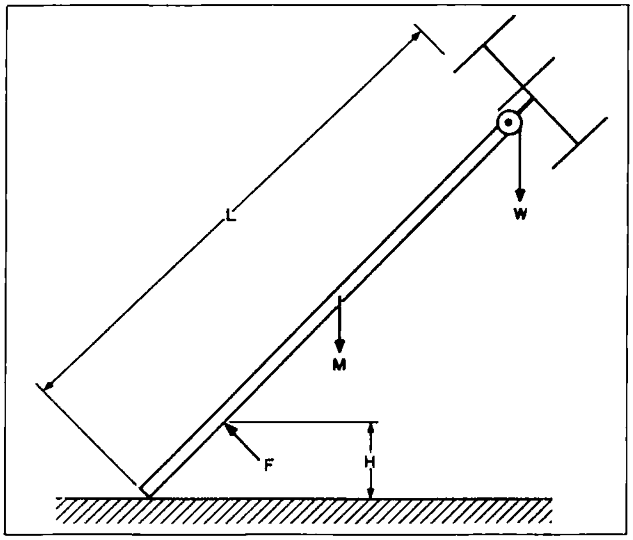


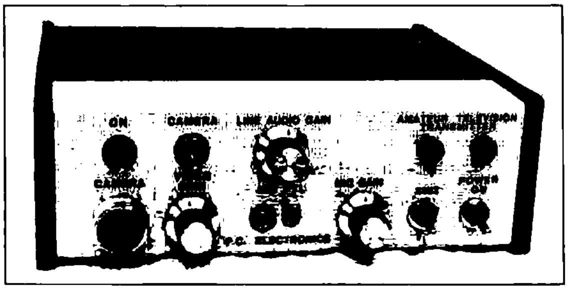
Figure 6. Forces associated with "walking up" a mast or tower.

As the mast is raised from the ground, the force required to keep the antenna from falling continues to increase until a 45 degree angle is reached, at which point it will equal (40)(60 + 80)/4(6) = 233 lbs. As mentioned above, that will be the force required if the erector is able to push at right angles to the mast. If he can't push at exactly a 90 degree angle, the required force will be even greater. Thus it becomes apparent why one or two persons trying to walk up even a relatively lightweight mast-antenna combination like this might find themselves in trouble. Why not try a little number crunching before risking crunching the yagi by trying to walk up a mast or hinged tower before knowing the forces involved?

Number 29 on your Feedback card

NEW PRODUCTS

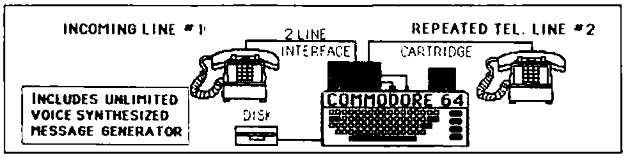
Compiled by Linda Reneau



PRODUCT OF THE MONTH

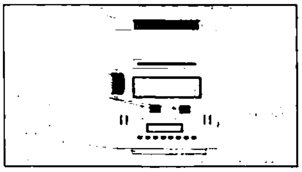
P.C. ELECTRONICS

P.C. Electronics introduces the new TX23 1 watt, 23cm (1240–1300 MHz) ATV transmitter, which enables the Novice class or higher amateurs, to transmit live action color or black and white composite video and audio from cameras, VCRs, or computers. It comes with one crystal on simplex 1269.25 MHz or specified ATV channels in the ARRL bandplan. The TX23-1 is small enough to carry in a knapsack for portable use. A switch is provided to select video and audio input. Two independent volume controls are also included. Power requirement is 12 to 14 volt DC at 600 mA, plus whatever the 12 volt camera draws. The antenna connector is a type N, and a BNC outputs to the receiving downconverter from the built-in RF T/R relay. The TX23-1 transmitter is $299 delivered UPS surface in the contiguous USA. *P.C. Electronics, 2522 Paxson Lane, Arcadia CA 91006; 818-447-4565.* Or circle Reader Service number 201.



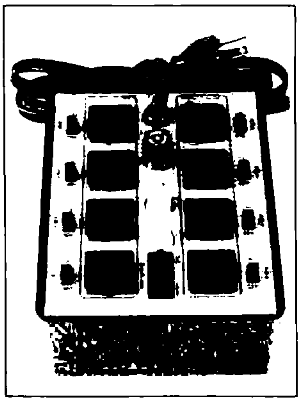
ENGINEERING CONSULTING

New from Engineering Consulting is their telephone repeater called Connect-A-Call. It includes voice synthesizer and three modes. Mode 1 is cellular (or any telephone) to WATS line, Mode 2 is cellular to remote call forward, and Mode 3 is auto-dial message call director. The Commodore 64, 64C, or 128 supplies the power. The Connect-A-Call has dual amplification and line ring detection, and remote hang up detection, safety timers, and programmable ring counter. Model CTW sells for $99.95. Model CS64W includes 2-line telephone interface, disk, telephone cables, and optional auto-boot cartridge for $399.95. Or circle Reader Service number 219 for more information.

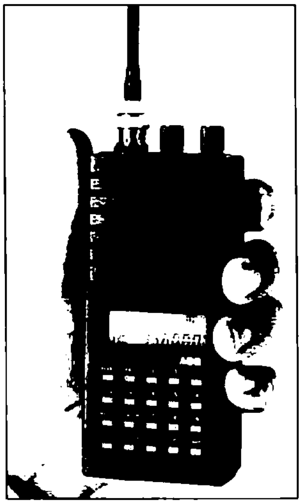


Engineering Consulting also has a Model PK-8, a 44-pin cartridge socket, including eight relay controls, two analog and alarm inputs, an expansion I/O, and cartridge slot to the CS64S for $149.95 *Engineering Consulting, 583 Candlewood St., Brea CA 92621; 714-671-2009.* Or circle Reader Service number 220.

KALGLO ELECTRONICS CO., INC



Kalglo Electronics has a new version of their 8- outlet console surge suppressor/noise filter. The Deluxe Power Console-Plus (DPC+) combines a quick response time (1 pico-second), 131 volt clamping, outlet wiring integrity checker, dual filtered and isolated banks, massive energy handling capacity, and a fail-safe system cutout. Separate status lights provide at-a-glance monitoring of both the protection circuits on all modes. The fail-safe feature will remove the system and connected equipment, from the AC circuit in event of damage to the internal protection components, to avoid possible damage from a second surge. A step up in Kalgo's SPIKE-SPIKER™ technology provides additional convenience and protection. Price is $125.95. *KALGLO ELECTRONICS CO., INC., Dept. DPC-PLUS, 6584 Ruch Road, East Allen Township, Bethlehem PA 18017-9359; 215-837-0700.* Or circle Reader Service number 202.

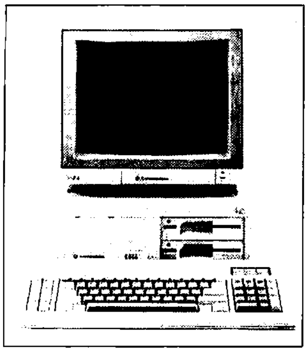


ACE COMMUNICATIONS

AOR. Ltd. of Tokyo, of which Ace Communications is a subsidiary, has a new AR800 handheld receiver with 800 MHz and channel scanning capabilities. It's small enough for your pocket, with the latest in Japanese circuitry. Its frequency coverage is 30–50 MHz, 118–136 MHz, 140–174 MHz, 436–512 MHz, and 830–950 MHz, with access to all police and emergency bands. The AR800 comes equipped with LCD, a rechargeable battery, and charger, for the price of $299. Circle Reader Service number 203.

M.M. NEWMAN CORPORATION

Heli-Tube® available from M.M. Newman Corporation, is a UV-resistant black polyethylene cable wrap and chafe guard for bundling and protecting wires or hoses. This expandable wrap applies like tape and resists abrasion, acids, alkalies, and solvents. Comes in six sizes from ⅛" thick to 1" thick for handling bundles up to 7". It has a 2000 psi tensile strength and maintains its qualities in extreme temperatures. Heli-Tube is priced from $.03 per foot, depending on quantity. *M.M. Newman Corporation, Charles F. Loutrel, Sales Manager, 24 Tioga Way, PO Box 615, Marblehead MA 01945; 617-631-7100.* Or circle Reader Service number 217.

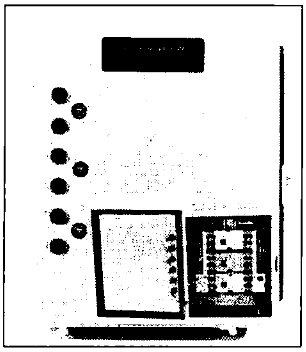


COMMODORE BUSINESS MACHINES, INC.

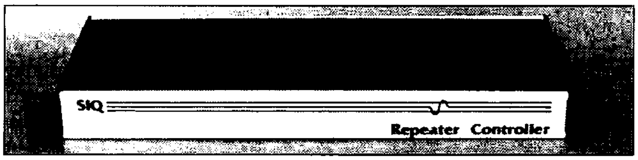
For the work-at-home market, Commodore introduces its Commodore Colt PC-compatible computer. The Commodore Colt features WordStar/Colt word processing software, 8088 microprocessor and offers 4.77 MHz and 7.16 MHz clock speeds, 640K, built-in graphic adapters (CGA, MDA, Hercules, Plantronics Color Plus), video and mouse interfaces and parallel and serial ports. These features eliminate the need to add costly expansion cards and avoid loss of valuable internal space. With its many expandable features and IBM-PC/XT compatability, the Commodore Colt is designed for ease of use. Suggested retail price is $899.95. *COMMODORE BUSINESS MACHINES, INC., 1200 Wilson Dr., West Chester PA 19380. Call Lori Cross, at Fleishman-Hillard, Inc. 213-629-4974 or Keith Lindenburg at 212-265-9150.* Or circle Reader Service number 205.

VERITE

Verite's Veri/Protektor™ is a high current power protector for multiple equipment. It withstands 150,000 amps of spikes, surges, and transient line noise. The company says it will custom-design units for special voltages and applications, including devices with EMI, RFI and noise filtering, and isolation transformers with electrostatic shielding. It is available in single-phase or three-phase configuration. The Veri/Protektor HC carries a 10 year repair-or-replace limited warranty. Prices range from $795 for single phase to $1,299 for three phase. *VERITE,*

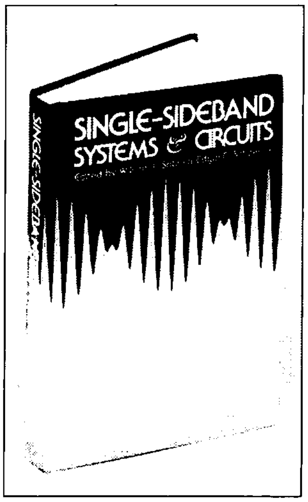


PO Box 697, Harbor City CA 90710-0697. Bill Ormsby, 213-832-1100. Or circle Reader Service number 208.



A-TECH ELECTRONICS

A-Tech announces the SIQ Repeater Controller. It provides basic repeater functions, Voice ID, programmable Morse code ID, Autopatch, Reverse Autopatch, audio mixing, 16 I/O lines which control link radio, PL tones, relays, and a complete manual. An optional phone patch board is also available. Touch tone commands are used to control the features such as the courtesy tones, tail squelch length, CW ID, and alarms. The SIQ repeater controller is available for $349.95. With phone patch, $449.95. *A-TECH ELECTRONICS, 1033 Hollywood Way, Burbank CA 91505; 818-845-9203.* Or circle Reader Service number 206.

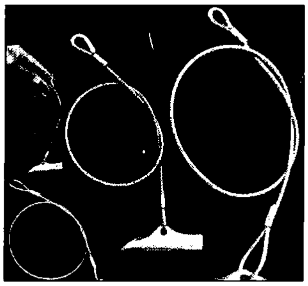


McGRAW-HILL BOOK CO.

Single-Sideband Systems & Circuits, edited by William E. Sabin & Edgar O. Schoenike, combines the expertise of 23 recognized authorities to bring the reader up to date on design, systems, circuitry, and equipment in radio and electronic communications technology. Mr. Sabin is a Design Engineer in the Advanced Technology Department, Collins Division, Rockwell International. Mr. Schoenike is Senior Technical Staff Member in the Advanced Technology Department. This 594-page, 6"x 9" reference book contains 378 illustrations and sells for $49.95. For more information write or call *McGraw-Hill Book Co., 11 West 19th Street, New York NY 10011; 212-337-5945/51.* Or circle Reader Service #215.

FORESIGHT PRODUCTS, INC.

Duckbill Antenna Anchors are available from Foresight. The Anchors have a holding capacities of 300, 1100, 3000, and 5000 lbs. The Duckbill is driven into the ground until only the cable loop remains above ground. An upward pull on the cable rotates the anchor into a perpendicular load lock position and compacts the earth, rather than loosening it. For further information, circle the number on the reader service card or contact *FORESIGHT*

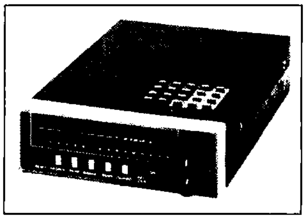


PRODUCTS, INC., 10780 Irma Drive, Unit 22, Northglenn CO 80233. Dick Allman; 303-761-3822. Reader Service number 207.

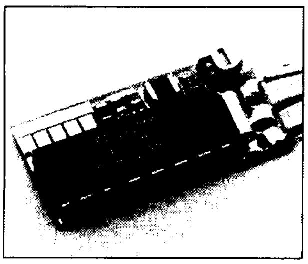
ACE COMMUNICATIONS

Also new from AOR is a 25-oz. mobile scanner, model AR160. The receiver covers 29–52 MHz, 136–174 MHz, and 436–512 MHz. It includes a fused DC power cable, telescopic whip antenna, mobile mounting bracket with hardware, and an AC to DC converter for indoor use. A battery retains the memory if power fails. Also included is LED display, 20-key access to the microcomupter, and high receptivity for only $189.

Ace Communications will handle product marketing and service



through their Monitor Division located in Indianapolis, IN. For more information contact *ACE COMMUNICATIONS, Monitor Division, 10707 East 106th St., Indianapolis IN 46256; 317-842-7115.* Or circle Reader Service #204.

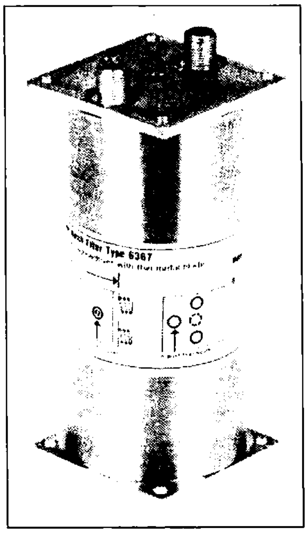


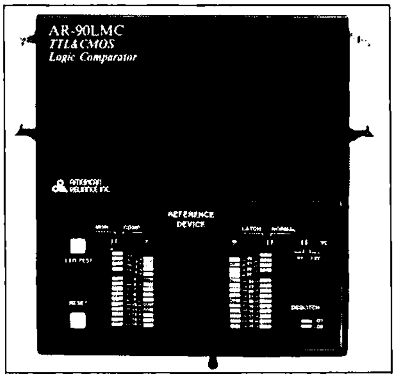
COMMUNICATIONS SPECIALISTS, INC.

Communications Specialists introduces the SS-32SMP, a programmable CTCSS encoder for hand-held radios and other applications with size restrictions. Any 32 tone frequencies between 0.01 Hz and 255 Hz may be selected for storage into a 32-bit EEPROM memory. The SS-32SMP may also be ordered to work as a six-tone encoder at no extra charge. Tone frequencies above 255 Hz may be ordered for a slight charge. The SS-32SMP features low impedance, low distortion, adjustable sinewave with adequate audio level to provide deviation for most hand-helds. It operates on 6–15 V DC so that voltage dropping resistors should never be required. The SS-32SMP is priced at $27.95. A Chip Component Kit for prototyping Surface Mount devices such as the SS-32SMP is also available. *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296. Michael Beveridge, Office Manager; 714-998-3021. FAX 714-974-3420.* Or circle Reader Service number 212.

MICROWAVE FILTER COMPANY, INC.

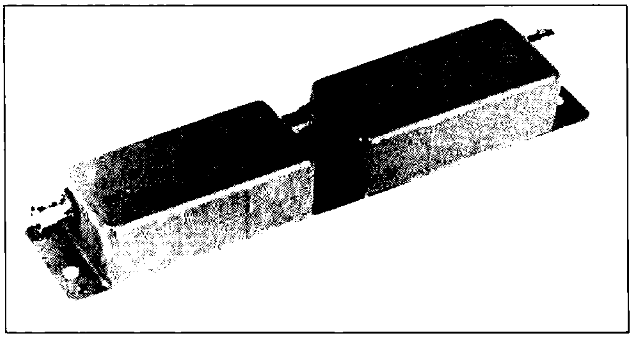
Microwave Filter Company introduces its 6367 series of tunable notch filters for 30–900 MHz. These filters cover an approximate 2:1 frequency range with an adjustable 3 dB bandwidth. Tuning range for model 6367-1 is 30–50 MHz, for model 6367-2 is 50–112 MHz, for model 6367-3 is 88–216 MHz, model 6367-4 is 216–450 MHz, and for model 6367-5 is 450–900 MHz. Minimum notch depth is 13 to 30 dB, depending on model. Price of models 1–3 is $139. Model 4 is $179 and model 5 is $169. Specify 50Ω BNC connectors or 75Ω F connectors. Or circle Reader Service number 209 for more information.





AMERICAN RELIANCE, INC.

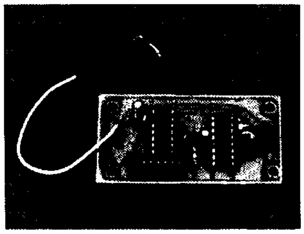
ARI announces their new Logic Comparator, the AR-90LMC. It features two modes of comparison, normal or latch, and allows direct viewing of logic states in the built-in monitor mode. A custom IC makes it possible to use both TTL and CMOS logic in a single model. The unit operates at 20 MHz and can detect a single timing error as short as 50 nanoseconds. The unit also tests ICs of up to 28 pins and includes both 16- and 28-pin test clips, an interconnect cable, carrying case, and operator's manual. Priced at $379. *American Reliance, 9241 E. Valley Blvd., Rosemead CA 91770; 818-287-8400. FAX 818-287-8855.* Or circle Reader Service number 218.



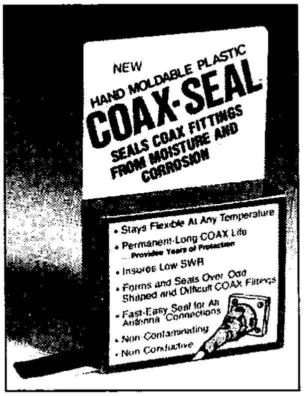
MICROWAVE FILTER COMPANY, INC.

Microwave also has a new bandpass filter, model 6209. This bandpass filter protects Ku-band digital information from interference by other satellite signals at the input to the receiver. Passband is 43–97 MHz and loss is 2 dB maximum. Return loss is 14 dB minimum. Lower stopband is 0–39 MHz and upper stopband is 105–450 MHz. Rejection for both upper and lower stopbands is 30 dB minimum. Impedance is 75Ω and connectors are BNC. The price is $225. For more information contact *MICROWAVE FILTER COMPANY, INC., 6743 Kinne St., East Syracuse NY 13057; 800-448-1666 or 315-437-3953, Ext. 52. For the Ku-band Receiver Bandpass Filter, ask for Jean Dickinson.* Or circle Reader Service number 210.

INTERNATIONAL RADIO, INC.



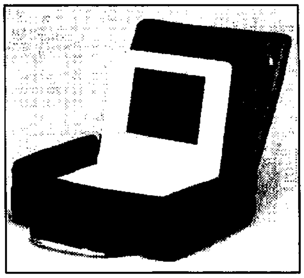
The IRI Bank Controller, a Kenwood accessory, is available exclusively through International Radio. It allows front panel memory bank control on the TS-940S, eliminating the need to open the hatch to change the memory bank. The IRI Bank Controller is a direct, plug-in substitute for the Voice Synthesizer. Through the "Voice" button, the user can step through all four memory banks. Fully assembled, CMOS circuitry, no power drain to memory backup cells. Price is $24.95 plus $5 for shipping and handling. *International Radio, Inc., 751 South Macedo Blvd., Port St., Lucie FL 34983; 407-879-6868.* Or circle Reader Service number 213.



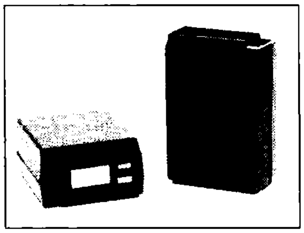
UNIVERSAL ELECTRONICS, INC.

Coax-Seal™ a rubber-based mastic sealant for coax fittings and connections, may be obtained from Universal Electronics. Coax-Seal stays flexible for eight years in extreme conditions and temperatures, which allows fittings to be disconnected and resealed. It is non-conductive, comes in a variety of shapes and sizes, and protects connector fittings from moisture, dust, and corrosion. A roll of Coax-Seal 60" long, ⅛" thick, and ½" wide on peel-away paper backing costs $2.49. Other sizes available. *Universal Electronics, Inc., 4555 Groves Rd., Suite 13, Columbus OH 43232; 614-866-4605.* Or circle Reader Service number 214.

JENSEN TOOLS, INC.



Jensen Tools offers Lap-Top Computer Cases in three models to accommodate NEC, Zenith, Toshiba, Tandy, and other popular lap-top computers. These soft-side cases are made of Propex. Model 363B001 is 18"x 13"x 4" and has an outside organizer pocket for the price of $109. Model 363B004 is the same size, but has a removable multi-pocketed portfolio that snaps inside the case cover for $129. Model 363B005 is 18"x 13"x 5" and includes an attached zipper close pocket for a computer printer as well as the removable portfolio for $149. For a free catalog of computer cases and accessories write or call *Jensen Tools, Inc., 7815 S. 46th St., Phoenix AZ 85044. Karen Richardson; 602-968-6241, Ext. 268, or 602-968-6231.* Or circle Reader Service number 211.



PERIPHEX, INC.

Periphex has Yaesu replacement battery packs for the FT-23R/33R/73R. The FNB-10, 7.2V 600 mA for 2.5W output, and the FNB-12, 12 volt 500 mA for 5 watt output, are both in stock. Charge with standard Yaesu wall or desk chargers. Both come complete with a 1-year guarantee. FNB-10 is $33, the FNB-12 is $49 plus $3 shipping. For further information on these or other battery packs, contact *Periphex, Inc., 149 Palmer Road, Southbury CT 06488; 800-634-8132 or 203-264-3985.* Or circle Reader Service number 216.

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

DIY CW KEYER

After two months of high-tech digital communications, it seems ironic that this month we're about to build a CW keyer. But what the hell, that's what we're going to do. This is such a simple construction project that it would be unfair to even consider it a "weekender." Perhaps a rainy Sunday afternoon would be more realistic.

The entire keyer is so simple that construction is limited to two integrated circuits. The timing and logic are supplied by integrated circuits 4027 and 4011 CMOS. A printed circuit board is also available, as is a complete kit of all parts, including the speed pot. All that is needed is a cabinet to install the circuit board. The small size of the PC board should make installation inside a small QRP transceiver painless. Take note, portable QRP ops: An extra box will no longer be needed when backpacking with HW-8 into the woods.

The printed circuit board is slightly larger than the 9 volt battery that operates the keyer. Don't worry about spending a lot of money on batteries either, the CMOS ICs consume such small amounts of current that there is no need for a power switch. A 9 volt battery should last about a year before it needs to be replaced. If installing the circuit board inside a radio, the host will supply the operating voltage. A battery will not be needed.

Basic Features

"How many bytes of memory does it have?" Whoa, looks like I forgot to mentions some small insignificant details. Hummm, in a word, none. In fact, it doesn't even have dot-dash memory.

"Well how about iambic keying?" Sorry. Not this time around. All this keyer does is make dots and dashes, except for the proper 3 to 1 timing for good-sounding CW. Remember, I said only two simple ICs. K-Mart specials, not large scale integrated circuits. Oh yes, I almost forgot, there is no on-board side-tone. A side-tone from the radio will have to be used to monitor the CW.

Figure one is the part placement for the keyer. This is from the component side of the printed circuit board. For those that want to "roll their own," figure two is the foil pattern for the keyer. Mike Michaels W3TS did the artwork from the original schematic. Speaking of original schematics, I did not design this keyer, but rather it comes from the German publications called *CQ-DL*. The keyer's schematic is shown in Figure 3.

Photo A. Not much larger than the 9 volt battery that operates the circuit, the QRPer CMOS keyer.

Easy Assembly

Construction is simple and straightforward. For assembly, a PC board is available or perfboard may be used. Somehow, I can't imagine why anyone would choose to build the keyer without the PC board. If CMOS chips have never been used in a construction project before, some simple handling instructions are in order. Because of the high input impedance of the chips, they are easily damaged by static charges. Before handling the chips, touch a gounded object to discharge any static electricity from the body.

> ***"This is such a simple construction project that it would be unfair to even consider it a 'weekender'."***

The chips must also be inserted in their sockets properly. Pin one may have a dot beside it, or the chip will have a notch on one end. This is shown in the part layout. If the instructions are not followed carefully, the chip may fail or cause the keyer to die. Some of the chips will have to have the pins straighten out before they can be inserted into their sockets. I place the chips along the edge of my work table, and press down to straighten one side. Turn the chip over and do the other side. Sockets are not necessary for this project, but it sure helps out when it comes to troubleshooting. If sockets are not used, then solder the ICs directly to the board using a grounded soldering iron. Watch that the chips do not get too hot!

After stuffing the printed circuit board, check over the work for errors. Then once everything is the way it should be, connect a 9 volt battery to the keyer. Adjust the speed control to mid range. The output of the keyer is an open-collector transistor. There shouldn't be any trouble keying either a HW-9 or HW-8. Almost all of the newer solid state radios will also key properly without modifications to the basic circuit. Grid block or cathode keying will require the use of an interface between the keyer and the radio.

To test the keyer, just connect up a VOM (set for ohms) to the output and short either the dot or dash paddle to ground. The meter should be seen deflecting. Adjust the speed and notice a change on the meter. Connect the keyer directly to the radio to avoid messing with a VOM. A VOM must be connected properly before the operator can tell if all is well. Some VOMs have the polarity reversed when using the ohm ranges. Just be sure to use a dummy load while testing.

After testing the results, install the circuit board into a suitable enclosure. If the circuit is being installed into a HW radio, double-sided tape will hold the board to an inside case wall. The speed control can be mounted on the rear or the front panel.

Troubleshooting

Oh No! Trouble. Well there is little that can go wrong. Check over the wiring once again and the placement of the components on the board. If all looks good, look at the base of the keying transistor with the probe of the VOM. Close the dot paddle (or dash paddle) and see if the transistor is being turned on. If it is, then there might be a bump 2N2222A or a wiring error from the transistor collector to the radio.

If the base is not seen going high, then look at the clock circuit. If the clock is not running, try replacing the 4011 IC. Check the clock again to see if it is running. The keyer will not work unless the clock is running. If the is clock running, but nothing is coming out of the keyer, swap out the 4027 chip. That should fix things up.

Now for the good part: I have collected together all the parts for this project, including the printed circuit board and IC sockets. Only a 9V battery is needed to finish the project. The cost of the kit, will be $9 postpaid in the USA. I'll throw in a copy of the enlarged parts layout guide. If one of these kits are of interest, don't delay! Only 25 are being made.

The printed circuit boards included in the kit were furnished by Tom Berryhill AB0Q from his

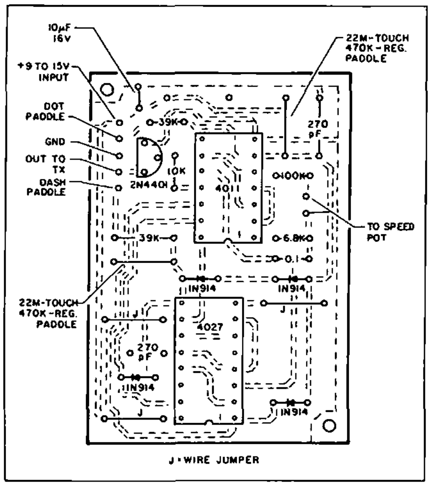


Figure 1. Parts layout from the top side of the board.

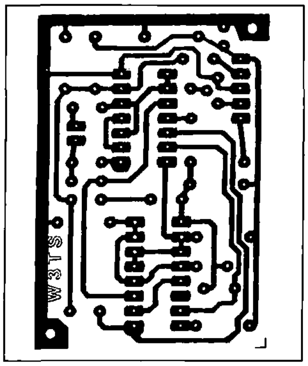


Figure 2. PC board, foil side. (Not to scale)

company Ditek Industries, Inc. Tom also provided the boards for the Two-Fer for me, and those who took up the offer to purchase one of those boards know first hand the quality of Tom's work. Tom is a mover and shaker. A welcome addition to ham radio.

This is one aspect of ham radio that, unfortunately many of us miss out on. Sure, working BY4IY with a microprocessor controlled Japanese made SSB transceiver is great, but some hams are missing out on some of the finest traditional pleasures, challenges, and achievements of our hobby. That's building one's own equipment. People with the talent like Tom Berryhill make it so much easier when the required parts are accessible. Building a TS-940 will not give the same feeling of satisfaction. QRP has put the fun back into the hobby. Not just into operating itself, but in tinkering, building, perfecting, and even in the special friendships between QRPers.

Well that is about all for this month. Next month we'll look at something that everyone has thought about at one time or another: solar power. Coming in September, the antenna issue will surely please those wire-stringers out there.

Sometime later on this year, I'll have details on a trophy I'll give away, the Homebrew DXCC award. Keep those soldering irons hot and watch for the details. ■

Is your library incomplete? Missing a key article for your QRP project? You can order back issues ($3.95 each) or article reprints ($3.00 for the first, $1.50 thereafter). Send your request to WGE offices.

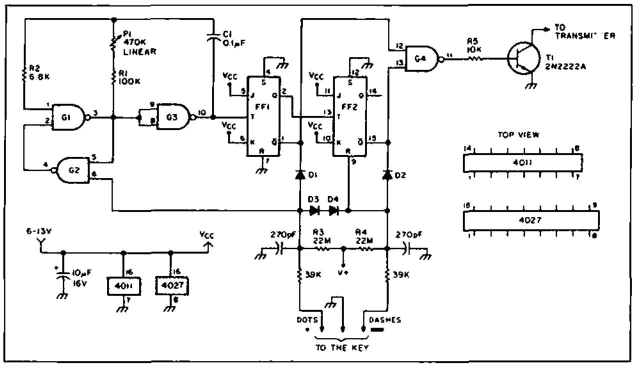


Figure 3. Schematic of the CMOS keyer.

Number 31 on your Feedback card

INDEX: July 1988

Issue #334

Number 32 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

URBAN ANTENNA RESTRICTIONS

Moving to a new location provides a great opportunity to straighten out the amateur satellite antenna system and put everything together the Right Way. No more old coax, failing relays, noisy rotators, or rusted bolts. Significant improvements, more efficient operation and a clean installation always wait at the end of the rainbow.

The Hunt Begins

Ten years ago, before buying my previous home on the far outskirts of Houston, I checked with the town's architectural committee about antenna restrictions. Their answer was that if my neighbors didn't mind, then they didn't either. No problem. It was a new subdivision and I didn't have any neighbors. HF, hamsat, and satellite TV antennas sprouted all around my yard. No attic antennas here, just aluminum and stainless up in the clear where it belongs.

Several months ago, when the house hunt in Houston began, I naturally requested a room for the radios and space for some antennas. This time, I needed only decent VHF and UHF antennas with a typical multi-band vertical to follow the AMSAT nets.

Having a ham for an XYL (WB5RMA) ensured that I didn't view houses with power lines running through the back, unair-conditioned "hobby shacks" or located next door to another ham.

The radio room was no problem but the antennas became a major concern. Many houses were unsuitable due to the local restrictions and covenants enacted by homeowners' associations and builders worried about property values. One subdivision refused a very small outside two meter and 70cm array, even when the proposal showed that the antenna would never be seen from the street. Due to the hobby, it was impossible to buy the choice house.

The search went on. Our realtor discovered that antenna restrictions were the first concern with area, school district, and the size and shape of the future home taking a back seat. Soon there was a large pile of deed restrictions on the kitchen table dealing with Houston's west side. Friends and co-workers provided suggestions on how to proceed and examples of the covenants from their areas. Some were surprised to find constraints that could preclude virtually any outside structure, including even a small TV antenna. I called the ARRL.

Rules and More Rules

The folks at Newington had a lot of experience with this problem. They were even to cover deed restrictions in the Washington Mailbox column in the April issue of *QST*. They offered to send a copy of the column prior to publication and gave me the callsigns of two lawyer hams in the Houston area available to discuss legal problems with local restrictions. I gratefully accepted the copy offer and proceeded with my antenna problems on my own.

Considering Houston is in the middle of a housing glut, the unyielding attitude of homeowners' associations, whose streets were rampant with foreclosures, astonished us. Surprisingly few subdivisions had acceptable schools, a reasonable commute, and the "ten-foot rule." This last guideline specifies that a homeowner can erect any antenna as long as it is behind the roof ridgeline and does not rise more than ten feet above the highest point on the house.

After some discussion, there were four possible homes. There was, however, a catch—an architectural control committee had to approve all construction, including antennas. I prepared a six-page proposal, showing top and side views of the proposed antennas, their relative position and size on the house, and photographs comparing these antennas with large TV antennas. This package went to the president of the homeowner's association.

Success! The proposed antennas were just a bit shorter than the largest Radio Shack TV antenna, appeared symmetrical, and would mount just high enough to clear any surrounding buildings to have a clean shot to the horizon. The Committee sent its approval in writing just before the closing date. The Purchase and Sales agreement included an antenna approval contingency.

Homework Pays

I was happy with the results, but amateur radio and future satellite chasers are faced with a significant problem. PRB-1 may constrict local municipalities and cities from enacting ordinances against reasonable amateur radio antenna installations, but it does nothing to restrain the actions of homeowners' associations and their deed restrictions. Many hams move into areas expecting few, if any, problems with antennas. Deed restrictions are not even discussed until protest letters arrive from the local organizations after the first antenna has gone up.

Hams who intend to install antennas should check local deed restrictions before they sign an earnest money contract, or else make the contract contingent upon antenna approval. Be prepared to wait for that approval. Although the homeowners' association president graciously cut through the red tape and informally approved our request in three days, it took five weeks for it to come through in writing.

Don't expect to get a copy of the deed restrictions at the closing, or from a real estate agent. Amateur radio operators who intend to pursue their hobby should secure a *complete* copy of any restrictions or covenants for their future home early in the negotiations. Watch the amendments, especially recent ones prohibiting satellite television dishes.

In the course of writing restrictions regulating satellite TV installations, the authors, in many instances, add clauses that directly affect microwave experimentation. Of the nine points listed in the dish guidelines for an area on the far west side of Houston, one, in particular, stands out. It specifies that only normal satellite TV reception shall be allowed. It goes on to state that no transmitting device of any type will be permitted. It's unlikely that anyone in the neighborhood will detect a ten watt 1.2 GHz signal for AMSAT-OSCAR-13's mode L uplink, but it's a violation nonetheless. This rule is typical of the many limitations that have been added to local deed restrictions.

Mode S downlink from the new satellite may not be a problem. The small feedhorn for a four-foot or six-foot dish does not attract much attention if it is painted to conform with other guidelines that define acceptable dish colors (usually black, when specified). Even with careful attention to aesthetics, don't expect to mount any dishes more than a few feet above ground. Most restrictions require that any dish not be visible to public view and not extend higher than ten feet above the grade level of the lot.

Until the FCC addresses the covenants, conditions and restrictions associated with private organizations, hams need to be careful. It's one thing to have a wire dipole in the trees for casual HF activity, but those hams who want to expand to serious DX, VHF or UHF operations may run up against the wall of homeowners' association and deed restrictions.

Updates

The hamsats in orbit as of this writing have performed very well. AMSAT-OSCAR-10 was made available for guarded use in mid-May. Activity may continue through July or August depending on the battery condition. Keep the power levels down and adhere closely to the schedules announced on the AMSAT nets and published in the Amateur Satellite Report.

Fuji-OSCAR-12 has operated satisfactorily with schedule updates every month, while RS-10/11 has been running mode A-K via the RS-11 unit. The K transponder using 15 meters up and ten down has been inactive for short periods, while the A transponder with its two-meter uplink and ten-meter downlink has been on continuously. I have had excellent results on many passes using 50 Watts to a Larsen mag-mount in the attic on two meters, and a longwire around the eaves of the house with a homebrew MOSFET preamplifier for ten meters.

The new OSCAR, A-O-13, known previously as Phase 3C, may already be in orbit by the time this issue goes to press. Check the nets and conversations on the older satellites for information. Even without delays, they won't allow operation until all systems on board A-O-13 are checked out, the satellite has achieved proper orbit, and spacecraft orientation is under control. This process requires a month.

Check those deed restrictions and get ready for some really exciting satellite chasing. 73

SPECIAL EVENTS

Ham Doings Across the World

BYRON MI
JUNE 18

The Independent Repeater Association is sponsoring its annual hamfest at the National Guard Armory from 8 AM to 4 PM. Free tables (make reservations) for dealers and sellers. Door prizes. Talk-in on 147 165/.765. Write or call *The Independent Repeater Association, 562 92nd St. S.E., Byron Center MI 49315; 616-455-3915.*

HARROGATE ENGLAND
JULY 2-4

The folks who brought you GB75USA, the Darley Amateur Radio Club of North Yorkshire, will operate GB4JUL as part of a joint US-UK celebration of American Independence Day. Operations will include all HF and VHF bands through 23cm and possibly Phase 3C, if the satellite is available for general use. QSL via GØFWG or the *Darley Amateur Radio Club, MHS, Harrogate, N. Yorks., England HG3 2RF.*

ARVADA CO
JULY 2-3

The Colorado Six Meter Invitational Net is sponsoring a contest from July 2 at 1400Z to July 3 at 0300Z. Exchange callsign, first name, grid square, S.I.N., if any (S.I.N. members, 3 points, non-members, 2 points) on 50 MHz. Score obtained by multiplying number of states worked by the number of points logged. First and second place winners receive certificates. Send logs including date and time of QSOs by July 31 to *NØAKI, [illegible]29 Fenton St., Arvada CO 80003. SASE appreciated.*

BRIDGEPORT WV
JULY 2-3

The West Virginia State Hamfest and ARRL Convention will be at the Jackson's Mill State 4-H Camp near Weston. Admission, $4. Talk-in on 145.39/4.79. For more information, contact *Hal Tate N8FXH, 121 East Olive St., Bridgeport WV 26330.*

CHATHAM ONTARIO
JULY 2-3

The Chatham Kent ARC will operate VE3CRC on the above dates from the 1988 FESTIVAL OF NATIONS to celebrate the variety of ethnic cultures in Chatham and Canada. Phone frequencies: 3.875, 7.240, 14.250, 21.360, 28.340. CW: 3.450, 3.725, 7.045, 7.125, 14.030, 21.090, 21.125. FM: 147.720/147.120 VE3KCR. For certificate QSL, contact *VE3CRC, Chatham Kent Amateur Radio Club, Inc., PO Box 264, Chatham Ontario CANADA, N7M 5K4.*

DEFIANCE OH
JULY 2-3

The Defiance county ARC will operate K8VON from 1600Z–2200Z from Historic Fort Defiance in celebration of the Defiance Flowing Rivers Festival. Suggested frequencies are 10–40 meter phone and CW bands. For certificate send a 9x12 SASE to *DCARC, Inc., Box 494, Defiance OH 43512.*

HANNIBAL MO
JULY 2-3

The Hannibal ARC, Inc., will operate WØKEM and issue it's annual special events certificate celebrating the National Tom Sawyer Days. Suggested frequencies: 7.240, 14.255, 21.340, and for Novices, 28.400. Send large SASE and personal QSL card to *Hannibal ARC, Inc., WØKEM, PO Box 1522, Hannibal MO 63401-1522.*

WILKES-BARRE PA
JULY 3

MURGAS ARC K3YTL is sponsoring its 9th annual Hamfest and Computerfest with an Ice-A-Rama at the Coal St. Sports Complex. VEC exams, large outdoor flea market ($3 per space), indoor space with tables available via advance reservation ($7.50 per space, $9 at door if still available). Admission $3. Talk-in on 146.61—53.61—146.52. For more information, contact *Jim Post KA3A, 15 Monarch Rd., Wilkes-Barre PA 18702; 717-825-3940.*

THOMPSON OH
JULY 4

KD8FJ will operate its 4th annual Heritage of Our Country, from Heritage Hill Camp in Thompson OH. Operation will be on 40 and 80 meters, lower end of phone band, and on 10 meters, 28.450. A large certificate is available for an SASE from *KD8FJ, 386 Cedarbrook Drive, Painesville OH 44077.*

STAUNTON VA
JULY 4-5

The Valley ARA will operate N4ICT with the Statler Brothers Happy Birthday USA beginning July 4 at 1200Z to July 5 0030Z. Phone frequencies: 3.855 MHz, 7.280 MHz, 14.250 MHz, and 28.375 MHz. Send QSL, contact number, and 9x12 SASE for certificate to *Valley ARA, PO Box 666, Staunton VA 24401.*

TORRINGTON WY
JULY 4-5

High Plains ARC will operate KB7KU at Historic Fort Laramie from 0000Z July 4 until 0000Z July 5. Phone frequencies: 3.850, 7.250, 14.250, 21.360 and 28.550. CW: 50 kHz up from lower band edge. QSL for business size SASE to *KB7KU, 3642 Bighorn, Torrington WY 82240.*

PEACE GARDENS ND/CANADA
JULY 7-10

Celebration of the 25th anniversary of the International Hamfest will be held in the Peace Gardens on the Manitoba, Canada and North Dakota, USA border from 9 AM CST to 9 PM CST July 7, 8, and 9, and from 9 AM CST to noon on July 10. Frequencies are 1.900, 3.885, 7.230, 14.230, 21.330, and 28.330. To receive the Peace Garden Award send a QSL and 3 IRC with SASE to *VE4XN, Dave Syndal, 25 Queens Crescent, Brandon, Manitoba CANADA R78 1G1.* To receive a QSL send a QSL card and one IRC with SASE to *KAØSLI, John Swanke, PO Box 304, Lakota ND 58344.*

SABA ISLAND
JULY 7-14

6 M DX Society members Mario Karcich WB2CZB, Jim Holt N3AHI, and John Laing W1EXC, are manning an expedition to Saba Island. Callsign PJØM, operation on all bands, 80 through 6, SSB and CW. Equipment: an FT757, two TS680s and amps, wire antennas on HF and 3 & 5L beams on 6. Members will explore 6 M multi-hop paths to the UK, Europe, and Americas. WB2CZB, member of QRP ARC International, will actively solicit QRP contacts. SASEs, please. QSLing is via *Mario K2MUB.*

SUMMERLAND BC
JULY 8-10

The Okanagan Ham-Fair Society is sponsoring its annual Ham Fair at Illahie Beach RV Park in Summerland from 4 PM Friday to 4 PM Sunday. Flea market, auction, new equipment, surplus, seminars, packet, repeaters. Admission, $5. Talk-in on 146.34/.94 or 146.52. Call *Glenn Borgens VE7GSB at 604-492-5684 or VE7BEE at 604-493-1122* or write *Okanagan Ham Fair, Box 477, Penticton, BC CANADA V2A 6K6.*

ALTOONA IA
JULY 9

The Des Moines Radio Amateur Association is sponsoring Hamfest '88 at the Adventureland Inn in Altoona. Admission is $4 in advance, $5 at door. Indoor commercial exhibit tables are $40 for the first table and $35 for additional tables. Indoor flea market tables are $5 each. VEC testing, seminars, free tail-gater flea market. Talk-in on 146.34/.94 and 440.5/445.5. For more information, write *Hamfest '88, PO Box 88, Des Moines IA 50301* or call *Jim Zellmer KAØVSL, 515-276-8949.*

BURLINGTON ONTARIO
JULY 9

The Burlington ARC invites all hams within driving distance to the 14th Annual Ontario Hamfest at the Burlington Central Arena from 8 AM to 5 PM. 180 fleamarket tables, computer/ham exhibits, packet forum, and the usual Superevent. Talk-in on 21/81 and 52 direct. $5 at door, $3.50 pre-registration. For details, write *Ontario Hamfest, PO Box 836, Burlington ON CANADA L7R 3Y7.*

OAK CREEK WI
JULY 9

The South Milwaukee Amateur Radio Club will hold its annual Swapfest as usual at the American Legion Post #434, 9327 S. Shepard Ave., Oak Creek WI 53154. Admission $3, prizes, exams, talk-in on 146.580 MHz FM Simplex. For details, write *The South Milwaukee Amateur Radio Club, PO Box 102, S. Milwaukee WI 53172-0102.*

INDIANAPOLIS IN
JULY 9-10

The 18th annual State ARRL Convention and Hamfest will be at the Marion County Fairgrounds. New equipment and computer wholesale dealers, supplies, home-brew components and hardware, flea market, technical forums all day Saturday, ARRL forums all day Sunday. Awards presented. Gate fee, $5. Children un-

der 12 free. For information on inside flea market space, call *317-356-4451*. For information on commercial building space, call *317-745-6389*.

LAKE CANTON OK
JULY 9–10

Oklahoma amateur radio operators will conduct annual Field Day exercises at the Big Bend picnic shelter. The Field Day is held in conjunction with the annual IARU "Radiosport" DX Contest. Simulated emergency operations, QRP contacts, solar power, and camping. Commemorative certificates for contacts with event stations WD5HPU, WA5LTM, and others from Lake Canton. Phone frequencies: 40/20/15/12/10 meter bands, and 6 and 2 meter SSB. Talk-in frequencies: 146.52 simplex, and the Fairview OK repeater, 144.85/145.45. I-40 travelers should use the Calumet OK repeater, 146.01/146.61. Send QSL and large SASE for certificate, or for more information, contact *Tim Mauldin WA5LTM, Lake Canton Field Day, PO Box 19097, Oklahoma City OK 73144; 405-682-2929.*

BELGRADE LAKES ME
JULY 9–11

The third annual World Emergency Communications Conference will be held at Woodland Camps, Belgrade Lakes ME on the above dates. For reservation information, contact *Betty Grant, IARN, Belgrade Lakes ME 04918; 207-495-2251.*

BATAVIA NY
JULY 10

The 8th annual Batavia Hamfest, sponsored by the Genesee Radio Amateurs, will be at the Alexander Firemen's Grounds. Indoor commercial exhibits, spacious flea market, VEC exams, breakfast and BBQ. Ticket $3 before July 1, $4 at the gate. Talk-in on 144.71/145.31 and 146.52. For more information, contact *G.R.A.M., POB 572, Batavia NY 14021*. For tickets, write *Knute Carlson N2DRX, 26 Burke Dr., Batavia NY 14020.*

BOWLING GREEN OH
JULY 10

The Wood County ARC is sponsoring its 24th Annual Ham-A-Rama at the Wood County Fairgrounds. Free admission. Doors open 8 AM to 4 PM. Talk-in on 147.18/.78 and 146.52. Tables $7, trunk sales $3 per vehicle width. For more information, contact *Jim Davis N8DWR, 10990 Newton Rd., Bowling Green OH 43402; 419-352-3321.*

DOWNERS GROVE IL
JULY 10

The DuPage ARC is sponsoring a Hamfest/Computer Show at the American Legion Post 80 with outdoor flea market and swappers row. Indoor tables available, dealers welcome. VEC exams (bring copy of license). Admission $3 at gate, $2 in advance. Talk-in: 146.52, 145.250-600, 224.55, and 442.55. For tickets or tables, send SASE to *Hamfest Chairman W9DUP, PO Box 71, Clarenoon Hills IL 60514; 312-985-0527.*

DUBLIN, IRELAND
JULY 10

The Millennium Birthday of Dublin will be celebrated by amateur radio operators from the heart of Viking Dublin on the unique callsign EI-1000. The Phoenix Park will host the city's birthday celebrations. A special QSL card will be available via the IRTS bureau or upon receipt of 3 IRCs. For further information, contact *Shane Halpin, D.M.A.R.C., 25 Knocknashee, Goatstown, Dublin 14 IRELAND.*

PITTSBURGH PA
JULY 10

North Hills Amateur Radio Club is sponsoring its 3rd Annual Hamfest at the Northland Public Library. Admission, dealer, and flea market space are all free. VEC exams, ARRL table, wheelchair accessible. Talk-in on 147.09. For Hamfest information, contact *Bob Ferrey, Jr. N3DOK, 9821 Presidential Dr., Allison Park PA 15101; 412-367-2393.* For VEC information, contact *John Rosenwald NM3P, 400 Stevens Dr., Pittsburgh PA 15237; 412-931-2631.*

GLACIER-WATERTON MT
JULY 15–17

The 54th annual Glacier-Waterton International Hamfest, sponsored by the Flathead Valley ARC will be at Three Forks Campground on the southern edge of Glacier National Park. Activities include 2 meter bunny hunts, QCWA meeting, seminars, contests, auction, swap tables, dealer displays, exams. Talk-in on 146.10/.70 and 146.52. For further information, contact *Flathead Valley ARC, PO Box 2549, Kalispell MT 59901 or Harold Schneider W7BKM; 406-862-4962.*

PETOSKEY MI
JULY 16

The Straits Area Amateur Radio Club will have its 13th Annual Swap Shop at the 4H Building on the Fairgrounds. Admission $2.50, tables $3, door prizes. VCR raffle tickets. Talk-in on 146.08–68 or 52. For more information, call *Irene at 616-539-8986, or Clark at 616-582-6455.*

WAPAKONETA OH
JULY 16–17

The Reservoir ARA will operate K8QYL from 1300Z to 2000Z on the 16th and 1600Z–2000Z on the 17th from the Neil Armstrong Air & Space Museum to commemorate the 19th anniversary of Armstrong's walk on the moon. Operation will be on 40 meters, phone, CW, RTTY, and Novice 10 meter phone. *John Prendergast WB8PEW.*

FAIRBANKS AK
JULY 16–24

Special event station KL7KC will commemorate during Golden Days the discovery of gold by Felix Pedro. Operation on CW and phone in the 10, 15, 20, and 40 meter bands. For QSL send SASE to *KL7KC, PO Box 81389, Fairbanks AK 99708-1389.*

AUGUSTA NJ
JULY 17

The Sussex County ARC will sponsor SCARC '88 at the Fairgrounds on Plains Rd. Registration $3, indoor tables $7 each. Tailgate space, $5. For further information, contact *Don Stickle K2OX, Weldon Rd., RD 4, Lake Hopatcong NJ 07849.*

FLUSHING OH
JULY 17

The Triple States Amateur Radio Club will hold its 10th annual Wheeling Hamfest/Computer Fair at Wheeling Park. Dealers welcome, big flea market, family activities. Admission $3 in advance, $4 at door. To reserve space, contact *Sandi Williams KB8AAV, 9 East High St., Flushing OH 43977; 614-968-3652.* For tickets, contact *TSRAC, Box 240, RD 1, Adena OH 43901; 614-546-3930.*

WASHINGTON MO
JULY 17

The Zero-Beaters ARC is sponsoring their 26th Annual Hamfest at the Bernie H. Hillermann Park. Free admission. Flea market parking $2. Talk-in on 84/24 and 52. FCC exams (bring license and copy). For more information, call *Al Lanwermeyer WBØOBS at 314-239-2072.*

INDIANAPOLIS IN
JULY 20–24

All amateurs are welcome to participate in the County Hunters' 20th annual convention at the Ramada Inn. The Indianapolis Zoo and 500 Motor Speedway will highlight the week. The Saturday banquet will begin at 7 PM with awards and major prizes. For information and registration, send an SASE to *Herb Morgan WD9GBH, 735 East 50th Street, Marion IN 46953.*

Number 34 on your Feedback card

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

Ponderings at 39,000 Ft.

It's just before midnight EST and most of the passengers aboard this westbound Boeing 767 are sleeping. We are about two hours from Los Angeles, and I've spent most of my time since leaving Dayton musing over the events of the past three days. One highlight was the surprise appearance of former FCC Special Services Division Chief Raymond A. Kowalski.

Ray quit his job with the FCC last December to join a Washington law firm. During his term, he was involved in many important rules interpretations and decisions, many which benefitted amateur radio. His "going-away present," however, did the service harm. The now infamous "Kowalski Letter" permitted the establishment of multiple repeater coordination entities serving the same geographic and demographic areas.

This letter brought him to Dayton and the third annual National Repeater Coordination Conference on the last Saturday of April. Ray felt he had an obligation to let those who coordinate repeaters know where they really stood in the eyes of the FCC, and now, in the private sector, he was free to say what he wished. What follows is the first part of an excerpted version of his 25 minute talk to over a hundred people, who represented repeater coordinators in most of the 50 states and several Canadian provinces.

What Ray Really Thinks

"...I probably won't be back to the Dayton Hamvention after this year, but I couldn't walk away without sharing with you what I've learned during my term with the Commission over the last five years. These are purely personal observations.

"...I think that lawsuits are completely out of place in amateur radio. I would hope that those who may be involved in them... would step back a little bit and see if there isn't a better way to accomplish what they are after in amateur radio...The legal fees are horrendous, and I pity anyone having to pay them. However, it's my personal view that lawsuits are the logical and natural result of the position the FCC placed ham radio in.

"...If I were in the current market and environment in amateur radio, especially in repeater coordination, I would be doing my damndest to push the FCC to change the ground rules!"

Double-Edged Sword

"...Ham radio's greatest strength—volunteerism—is also its greatest weakness. Many hams have come forward to do onerous and thankless jobs—such as repeater coordination and band planning. Unfortunately, these actions have no recourse in law or regulation, for they are, in essence, 'gentlemen's agreements.'

"...The problem is that amateur radio is starting to see people exploiting that. The autonomy of amateur radio allows the few self-serving hams to impose that much more on the honest and charitable majority.

"Why is this happening? Apart from the nature of ham radio, as described above, this Service, like many others, was deregulated five–six years ago. The idea was to let the marketplace regulate what goes on in radio to the greatest extent that it can and let the FCC get out of the business of regulating. The FCC applied that philosophy across the board in all radio services, including amateur radio.

"I hope that some of you will go back and reread my interview in *CQ Magazine* when I was first appointed to the Commission. I said there that deregulation wouldn't work in amateur radio. There's no marketplace force, no competitive engine that drives amateur radio. What must serve in place of a marketplace for amateur radio is regulation.

"Most people shudder at the thought of more regulation—it's not the American way to invite more government interference. But this is exactly what amateur radio needs—the Service has more autonomy than it can adequately cope with.

"Amateur radio has an absurd licensing situation when it comes to repeaters. The model of amateur radio regulation is based on point-to-point communications. Repeaters ostensibly merely extend the distance between those points. They are akin, however, to land mobile or broadcast station operations because of the tremendous range that repeaters have. One of the reasons repeater coordination presents so much trouble is that it doesn't fit the regulations that generally govern amateur radio.

"I sat in on a repeater coordinators' meeting this morning and saw that most of the attendees had immediate issues to attend to in their local clubs. Hams must make every effort, however, to step back and look at the big picture. They need to see that there's something different about repeater coordination that requires a different regulatory approach."

Look for the continuation of Kowalski's speech in next month's Looking West.

Number 35 on your Feedback card

Dx

Hams Around the World

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

Islands On The Air

Looking for a new DX challenge this summer? Many DXers are finding the Great Britain-based Islands On The Air (IOTA) program an exciting addition to their quest for DXCC and Worked All Zones.

The IOTA program involves working and confirming stations located on more than 400 islands and island groups in all corners of the globe. Like DXCC, the initial award level is for 100 islands, with additional awards at 2, 3, and 400 levels. The IOTA program includes 11 other awards, most for working 75% or more of the activated islands in each geographic region. These latter awards cover the six continents, Antarctica, Arctic islands, the West Indies, and the British Isles. (In regions with more than 100 activated islands, the DXer can earn the award by confirming 75 islands.) To qualify for the IOTA World Diploma, the DXer must confirm 50% of the activated islands in each of the seven continental areas.

Geoff Watts founded the IOTA program in the mid-1960s. Since 1985 the Radio Society of Great Britain (RSGB) has administered the awards, under the supervision of Roger Balister G3KMA. (Geoff Watts, by the way, is a British short wave listener who edited the weekly *DX News Sheet* in England for many years, the only non-ham member of the DX Hall of Fame.)

The Appeal

The Islands On The Air program appeals to DXers for two main reasons. First, the program provides a new challenge to the DXer who is running out of countries to work under the DXCC program. With hundreds of islands to chase, the DXer will not run out of potential IOTA credits for many years. The other primary appeal of the program is that almost any DXer can be DX, by operating from one of many IOTA islands.

Island DXpeditioning is very popular among EuropeanDXers—so popular in fact that the IOTA administrators have stopped accepting applications for new islands in Europe. (The latest IOTA directory lists 110 European islands!) DXers can get to many of these islands by automobile, commercial transportation, or a short boat ride. Since many of the islands don't have resident amateurs, the only time a DXer can make contact with an island is via an island DXpedition. The summer months see many such mini-DXpeditions by hams from almost every country in Europe.

> ***"Any recognized island, island group, or subgroup, as listed in the National Geographic Society's World Atlas can receive an IOTA designation."***

Most such trips are single weekend affairs, with a simple transceiver and portable antenna, a far cry from the elaborate, time-consuming, and expensive DXpeditions to rare DXCC locations, such as Howland Island or Kingman Reef. The ease with which a DXer can activate an IOTA island is a major benefit of the program.

North American Islands

What counts for IOTA? Any recognized island, island group, or subgroup, as listed in the National Geographic Society's World Atlas can receive an IOTA designation. To simplify IOTA hunting, the IOTA administrators provide an IOTA Directory that lists some 600 possible IOTA credits. In North America, the directory is available for US $3 postpaid from *The DX Bulletin*, Box 50, Fulton CA 95439.

Among the IOTA credits on the Atlantic coast of the United States are: Mount Desert Island in Maine (NA-55), Nantucket (NA-46), Block Island (NA-31) off Rhode Island, Long Island (NA-26), the Chesapeake Bay (NA-83) and Hattaras (NA-67) groups, Sea Island (NA-58) and Cedar Key (NA-76), and the Florida Keys (NA-62). In the Gulf of Mexico, there's Florida's Marco Island (NA-52), Sanibel group (NA-69), Tampa Bay peninsula group (NA-34), Ship group (NA-82), and Chandeleur Island (NA-??). On the West Coast IOTA, credits are the Channel Islands (NA-66), the Farallons (NA-??), and the San Juan Archipelago (NA-65). IOTA does not assign a number to an island until it is "activated" by an accredited operation.

These islands show the wide range of available IOTA credits. For example, a IOTA DXer can drive to many of these islands, such as the Florida Keys, Marco Island, Mt. Desert Island, Long Island, and the Hattaras group. Others are a short ferry ride away: Channel Islands, Nantucket, Block Island, and the San Juans.

On the other hand, some of the islands within a few miles of the US coast have never seen IOTA activity. They fall into the "inactivated" group. These 200 or so islands that will count for IOTA, once an IOTA DXer operates from that island. The St. George group on the Florida panhandle has not been on the air for IOTA, despite regular ferry service. Other potential IOTA credits off the US coast have not been on the air for very good reasons. For example, the Marquesas group off Key West, and the Farallons near San Francisco are wildlife refuges. Authorities are reluctant to approve DXpeditions among nesting birds and sea life.

A more adventuresome DXpeditioner can find many more IOTA islands in North America. Canada has 25 activated and inactivated IOTA credits. The more common islands include Newfoundland (NA-27), Cape Breton (NA-10), Prince Edward Island (NA-29), and Vancouver Island (NA-36). The islands that have not yet seen IOTA activity are all rather inaccessible: islands in the Hudson Bay, and Akpatok Island in the Arctic.

Alaska has 24 potential IOTA credits, only 14 of which have been on the air. Anyone for a DXpedition to Walrus Island this summer? One Alaska IOTA credit of particular interest is thePribilof group (NA-28). The Alaska DX Association tried for years to get the Pribilofs added to the DXCC country list, without success. At least the Pribilofs count as a New One for IOTA.

An interesting wrinkle to IOTA is that some islands that count separately for DXCC are lumped together into a single IOTA credit. For example, the Diomede Islands in the Bering Strait count as a single IOTA entity (no number yet assigned), but two DXCC countries: Alaska KL7 and Asiatic RSFSR UAØ. Similarly, many of the Caribbean DXCC countries are lumped into the Windward Islands (NA-25), the Leeward Islands (NA-22), and the Greater Antilles (NA-15). Thus Montserrat VP2M, AnguillaVP2E, Antigua V2, Dominica J7, Guadeloupe FG, and others all count for NA-22, despite separate DXCC status.

To get started in the IOTA program, try tuning in the IOTA net on 14260 kHz at 1300Z on Saturdays. Most IOTA DXpeditions try to hit this spot, and many IOTA regulars will be pleased to provide information for the new island chaser. DXers can find details on future IOTA DXpeditions in RSGB's *DX News Sheet*, or in some of the weekly stateside DX newsletters. Meanwhile, look through those OSLs for possible island confirmations, and set up a check sheet for IOTA credits confirmed. Finally, consider an island DXpedition this summer!. . .de VP2ML NA-22.

> ***"An interesting wrinkle to IOTA is that some islands that count separately for DXCC are lumped together into a single IOTA credit."***

[Don't miss the 1988 Northwest DX Convention July 22–24, at the Richmond Inn, Richmond, British Columbia. Registration is US $40 to the sponsoring British Columbia DX Club, c/o Ken Thompson, Box 3048, Blaine WA 98230.]

73 INTERNATIONAL

edited by Richard Phenix

Notes From FN42

Last month we noted that the International League of Amateur Radio Esperantists has a membership of over 350, that 18 of the 80 nations represented at a world conference last year had representatives in the ILARE, and that 162 stations in 22 nations participated in the annual international contest in Esperanto (on the HF bands, third weekend in November). That gives you four months to learn the language before this year's contest, and here is how you get started.

Send a business-size SASE (use IRCs if you write from outside the U.S.) to ***Esperanto STI, 195 Partridge Road, Pittsfield, MA 01201, U.S.A.*** *and accept a 10-free-lessons offer! You get one lesson at a time, sending in your work on each, with SASE (or SAE with IRCs) to get the next one. You will be put in touch with the Esperanto center nearest to you. "Dankon," (Thank you) say you? "Ne dankinde!" (Don't mention it; you're welcome!)*

Esperanto is about 100 years old. Each of its 28 letters is always pronounced the same way, words are spelled as they sound, and are "grammar coded." Nouns end in O, adverbs with an E, adjectives with A, and verbs with AS (present tense), IS (past), OS (future). "The" is always la, for singular, plural, object, subject (no word for "a" or "an" and there is no masculine or feminine for inanimate objects, as in many languages). There are 16 fundamental rules of grammar, with NO exceptions.

We already have one common language: Morse code. What great communications would take place if we could speak to each other all around the world! Esperanto, which is neutral on all matters of politics, economics, and religion, already has a worldwide presence—an estimated eight million read, speak, and write it—and an extensive literature—prose, poetry, technical matters, etc. Easy (facila) to learn; not difficult (malfacila).

We are indebted to Allan C. Boschen, a former Director of the Esperanto League for North America, for the above. He is an electrical engineer and has both taught and worked in his profession. He is a Senior Member of the IEEE.

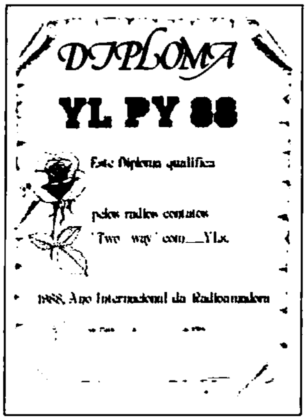
July dates: This is a great month for Independence! It is Independence Day for the USA on the 4th, for Venezuela on the 5th, Argentina the 9th, the Bahamas on the 10th, Colombia on the 20th, Liberia on the 26th, and Peru on the 28th. Viva!

Canada Day is on the 1st; 6—National Day, Malawi (17th is National Holiday, Iraq, and for Belgium on the 21st); 14—Bastille Day, France; 18—Liberation Day, Nicaragua (National Liberation Day, Poland, the 27th); 19—Martyas Day, Burma; 23—Revolution Anniversary, Egypt (31st for the Congo); 24—Aniversario de Bolivar, Latin America; and Cuba celebrates National Rebellion Day on the 26th.

Roundup

Africa. Wayne had a newsy letter from 5Z4BH (a new call) in Nairobi, in which 9X5AA and 5H3ZO are mentioned, along with casual references to Kigali, Ethiopia, Somalia, Djibouti, Tanzania, and Dar Es Salaam.... This column would welcome items from those parts of the world. Let's hear from you.

Brazil. From LABRE/São Paulo Executive Secretary João Iva da Fonseca Netto (PY2OT): The YLPY88 Award, for working PY "YL" stations during 1988. All bands, CW or phone, also available for SWLs, QSLs not required, only GCR log info: date, call, time, mode, RS/T band. CW contacts are worth 11 points; phone contacts are 8 points; 88 points are needed. Send application with 10 IRCs to LABRE DS/SP—YLPY88, PO Box 22, São Paulo - CEP 01051, Brazil.



British West Indies. Roger Corbin ZF1RC and Bruce E. Miller ZF2KN are now, respectively, president and secretary/treasurer/QSL Manager for the Cayman Amateur Radio Society. Address for the latter: PO Box 1029, Grand Cayman Island, BWI. And he reminds us that the 12, 17, and 30 meter bands are not authorized for use in the Cayman Islands, and 160 operation is limited in power to 75 W for class A operators and 20 W for class B operators.

France. More and more references to packet. "I think you would be interested in knowing that French packet amateurs are making lots of QSOs. . . and plan to set up nets, as in California and elsewhere stateside. Contacts between Sweden, Spain, British Isles, Germany, Malta, and Sardinia are common [and] even behind the Iron Curtain. . . Poland and Yugoslavia." So writes SWL Jean R. Boucton F11DPM. [*How about writing us a page or two on "Packet Radio In France," or some such title, for use sometime in this column?—Ed.*]

Photo A. John F11DPM.

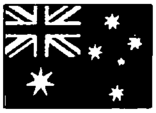
World. From time to time it is good to remember there is (and has been, for 123 years) a membership organization, now 163 countries strong and now a specialized agency within the United Nations, called the International Telecommunications Union (ITU). Among its many sub-groups is the World Plan Committee—which met in Portugal last February under the chairmanship of C. R. Crump (of the USA). It receives reports from countries on their respective trends in planning activities, developments, and data on past, present, and projected volumes of telecommunications traffic.

Also in February, in association with the Department of Telecommunications of India, the ITU brought together over 100 representatives from 42 Asian and Pacific countries to plan a Regional Development Conference. The conference focus: the implications of the prediction that "by the early part of the next century, virtually the whole of mankind should be brought within easy reach of a telephone and, in due course, the other services that telecommunications can provide." [*Meaning us, among others.*]

In May there was the Americas Telecom exhibition and forum in Rio de Janeiro and a policy symposium on development strategies for Latin America. May 17 annually is World Telecommunications Day, and this year's subject was "the transfer of technological know-how in the age of electronics." Its purpose was to focus attention on the roles of modern telecommunications in the economic and social development of nations.

Between late August and early October this year there will be a World Administrative Radio Conference in Geneva on the use of geostationary-satellite orbit and on the planning of space services utilizing it. In October of 1989, Geneva hosts the World Electronic Media Exhibition and Symposium.

Heady stuff that affects hams worldwide, eventually. If you are interested in more details, write the ITU, Place des Nations, CH-1211 Geneva 20, Switzerland. You may request that information come to you in English, French, or Spanish.



AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

[Jim headed this latest report on EXPO88, "APOLOGY." He owes us none. . . it was an army of Murphys (Murphies?) who do. Mix together bureaucracies (which every nation has) and our magazine lead time and you come up with Jim's report in the April issue. It was overtaken by Murphy events in late March in Australia, far too complicated to describe, but be-

NATIONAL CAPITAL CERTIFICATE RULES

All amateurs and SWLs worldwide are eligible. Contacts (SWL reports) valid from 1301 UTC December 31, 1987 to 1300 UTC December 31, 1988.

POINT REQUIREMENTS

Category	Section	Points Required
1. HF (Under 30 MHz)	VK Call Areas (not VK9/VK0)	50 Points (incl. VI88ACT)
2. HF	Non-VK Call Areas (incl. VK9/VK0)	20 Points (incl. VI88ACT)
3. VHF+	VK Call Areas (Above 30 MHz)	50 Points (not VK9/VK0)
4. VHF+	Non-VK Call Areas (incl. VK9/VK0)	8 Points

Each application in Categories 1, 2, and 3 must include at least one of the Australian VI88 special event callsigns. Those for HF must include a contact with VI88ACT.

HF contact with any Australian callsign = 1 point; with any VI88 special event callsign = 5 points.

VHF contacts between stations up to 30 km. = 1 point; and over 30 km. = 4 points. Contact with any Australian VI88 special event callsign counts for 10 points, i.e., VI88ACT or any other VI88 prefix.

For VK operators only: Except for the VI88 special event callsign, all contacts must be outside area operated from.

Any VI88 special event callsign may be claimed only once per band per mode. (E.g., VI88ACT on 20m SSB and 20 CW = two contacts—10 points, because of different modes.)

QSL card confirmation of contacts claimed not required.

Any band or mode within the terms of the applicant's license is accepted; endorsement requests will be considered. E.g., if all points claimed are for contacts on a single band or mode, an endorsement to the Certificate would be possible.

Contacts made by any terrestrial voice repeater method are not valid. Packet radio contacts using digipeater(s) are valid.

Send Aus.$4.00 or 7 IRCs with your application; send logs or log extracts for each contact claimed, with callsign, date, UTC time, mode, band, signal reports exchanged, to the VI88ACT Awards Manager, GPO Box 600, Canberra, A.C.T. 2601, Australia. NOTE: Claims must be certified as a true and correct record by at least one licensed amateur other than the applicant. (This requirement may be waived for applicants in remote areas—send an explanation if you wish to claim a waiver.)

yond the control of the WIAQ EXPO88 Committee, and absolutely ruinous to their plans. And until now we could cover the disaster only with that tiny LATE NEWS box in the June issue. Here now is the official information on the WIA Bicentenary observances. It comes over the signature of Daniel R. Steiner VK1ST, Chairman, Bicentenary Sub-Committee.—Ed.]

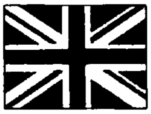
All Australian amateurs may use the AX prefix to replace the VK; and the Department of Transport and Communications has provided one VI88 prefixed callsign for each state and territory (see box). The Australian Capital Territory station, VI88ACT, has been active to date as follows:

- Australia Day, January 26—many contacts made
- Canberra Day—during the March 19/20 Annual John Moyle Field Day Contest
- On the May 9th occasion of the opening of the new Australian Parliament House. (As of this writing, Queen Elizabeth II, the Queen of Australia, is to open the House, and VI88ACT will operate from 2200 UTC, May 8, through 1000 UTC, May 9, on 80 through 10, using frequencies ending in 88—3.588 MHz, 7.088, 14.188, 14.288, 21.288, etc.)

State/ Territory	Callsign VI88
New South Wales	NSW
Victoria	VIC
Austr. Capital Terr.	ACT
Tasmania	TAS
South Austr.	SA
West Austr.	WA
Northern Terr.	NT
Queensland	QLD
Polonia RC (Victoria)	ABC
World Expo (Brisbane)	XPO

All VK1 amateurs will be encouraged to operate the VI88ACT call at least once during 1988.

VK1ST notes particularly that a special QSL card and an Australian Bicentenary National Capital Certificate will be offered. They are a matched pair. Each VI88ACT contact will qualify for a QSL. See box for Certificate details.



GREAT BRITAIN

Jeff Maynard G4EJA
32 Waldorf Heights
Hawley Hill
Camberley GU17 9JQ
England

The UK Scene

Good news for us! The license fee for UK amateur radio operation will remain at 12 pounds (about $20) for the next 12 months. Our regulatory body, the Department of Trade and Industry, recently announced a revision of the 47 different types of UK radio licenses (*yes, I said 47!*), and 25 of them got increases, as is normal for "revisions," but for once the amateur community was not affected.

The DTI has also released GB75 prefixes for club stations wishing to run demonstrations during this 75th anniversary year. The main purpose of the calls will be to demonstrate amateur radio to the general public, so operation by both Class A (HF) and B (VHF only) stations so-licensed must be such that the public has full access. They will be in conjunction, therefore, with town shows, festivals, village fairs, and the like. And not of the "five nine-go" contest style, one hopes. Amateur radio is difficult enough to explain to the man-in-the-street without the jargon.

The RSGB (Radio Society of Great Britain) is planning a series of 75th Anniversary events, which was to be published in the April issue of *RadCom*. Some events will be fully subscribed by the time you read this, but I am sure the RSGB can make a special effort to accommodate overseas visitors. Contact them directly for full information.

One such event, of special interest to RTTY enthusiasts, is an inaugural Data Symposium on the 22nd and 23rd of this month (July) at the Harrow School (which by itself is a treat for tourists), a few miles NW of Central London. RTTY may be thought of as old hat, but it really is the original form of data transmission. If it had been invented in the 80s, it would have be hailed as a major breakthrough.

Reminder: The British Amateur Radio Teleprinter Group (BARTG) transmits news bulletins on the first and third Sundays of each month on 3590 kHz and 14.090 MHz. Get details from and send contributions to: Bob Andrews G1JZJ, BARTG Manager, 5 Queens Road, Erdington, Birmingham B23 7JP, England.

NEW ZEALAND

Des Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

2300 MHz E-M-E World Record. During last October's ARRL International Moonbounce Contest a new world record was established between W3IWI (National Radio Astronomy Observatory, Greenbank, West Virginia) and ZL2AQE (Wellington), on October 18.

In John Shortland ZL2AQE's words, after disappointing beginnings and several phone calls to Greenbank, he found his 150-watt final was not radiating. Other ZLs had given up by now, but he decided W3IWI "was not going to get off the hook so easily." He patched out the final high power stages and ran the driver into the transmit feeder, giving an approximate power output of 6W at the dish feed. He made another quick call to Greenbank—and back at the transmitting position he heard W3IWI (Jay K5JL, operating) come in with an excellent signal strength as before. John answered and exchanged reports and confirmations, and then the stations broke the normal sequencing and exchanged greetings and congratulations: They had completed a world record distance for a two-way 2304-MHz contact. (See box for equipment data.) It was fitting that John and Jay were the operators. Jay has been helping ZLs in EME for some time, and John has been experimenting for some time with power production levels of over 100W at 2304 MHz. He has developed two

EQUIPMENT DATA	W3IWI	ZL2AQE
Antenna	140'	12'
Tx Power	100W	6W
Rx noise	1dB	1dB
Beam width 3dB	.24°	1.5°
Track method	Auto	Manual
Polarization	-EME circular-	

high-power 2304 amplifiers. No doubt this year will see them, Ted ZL2TAX, Steve ZL2AZQ, and many others in the moonbounce contest. Keep an ear open for us!

A 50th Anniversary. On January 4, 1938, the Electrical and Wireless School opened to train the first Signals personnel in the then-new Royal New Zealand Air Force. The recent 50th anniversary celebration was like a mini hamfest, with more than half the 300 ex-students present being licensed amateurs.

With WW II breaking out in 1939, the school expanded rapidly, and by 1945, 5290 airmen and -women had been trained for eleven different jobs including wireless operators, telegraphists, DF operators, teleprinter operators, and radar operators. The postwar amateur radio boom was mainly due to the introduction to radio communications of such a large number of men and women in the Army, Navy, and Air Force.

Fraternal Twin Clubs? is there another Hastings Amateur Radio Club anywhere in the world? If so, The Hastings ARC of New Zealand would like to make contact with you and exchange information and greetings some time in August and/or September, possibly on 20 meters, perhaps as the first of many goodwill exchanges. Research shows towns of that name in the U.S., Canada, England, and Australia. [*In the U.S., in Florida, Illinois, Michigan, Minnesota, Nebraska, New York (and a Hastings-On-Hudson also in NY), and Pennsylvania; there is a Hastings on the West Indies island of Barbados also.—Ed.*] If there is a radio club in one of these Hastings please quickly write airmail to the secretary of our Hastings ARC: Hugh Thornton ZL2TKL, 404 Hart Drive, Hastings, New Zealand so that we can set up a sked.

PORTUGAL

Luiz Miguel de Sousa CT4UE
PO Box 32
S.Joao do Estoril
2765 Portugal

Photo B. REP Chairman Carlos Nunes CT1CDL receives a plaque from IARU Secretary John Allawy G3FKM and Olga, his secretary. (Photo by Joao Lagoa CT1CFH)

January 28 was historic for REP. Celebrating its 60th anniversary, a ham convention was held in Caldas da Rainha, 55 miles north of Lisbon, one of a number of charming towns and villages in the beautiful hilly region famous for pottery making. Local mayors, tourist departments, and hams like Felizardo CT1ALF, and such guests as IARU Region 1's secretary, Mr. John Allawy, and Mr. Gonzalo Pomares, chairman, URE-Union de Radioaficionados Espalholes made it a success.

During the four days (at the Hotel Malhoa) sessions reached agreements on many subjects. Hams should promote amateur activity among the general public; should hold seminars to create new hams; should participate in international ham events to exchange ideas and keep up with new technologies, and working groups should study these technologies.

It was confirmed that Portugal would be the location for the 1990 IARU meeting; Portugal's radio pioneers were remembered and honored, and a visit was made to Portugal's Earth/Satellite station at the Companhia Portuguesa Radio Marconi site.

We had Jurgen Matthes DF6OM and YL as visitors from West Germany recently. He is a member of the International Air Traffic Controllers Net (IATCN)—tune daily on 14.277 kHz at 1130 GMT to hear more about it.

Among foreign hams living in Portugal I've found another friend, Gary Holt N7GHD—living right across the street! He likes CW, phone, and SSTV, and is available to climb crank-up towers when we need him!

Best 73 to all, 88 to the ladies.

THAILAND

Tony Waltham HS1AMH
International Liaison Officer
Radio Amateur Society of Thailand
PO Box 2008, Bangkok
Thailand

Within a few months we expect operations by licensed operators to resume in Thailand. Under new regulations, operations at first will be only from club stations.

At the end of 1982, the Society (RAST) advised its members transmitting HF to go QRT while the Post and Telegraph and security agencies reviewed the question of amateur radio with regards to fully legalizing the activity—as has now been done. In order to maintain Thailand's presence on the HF bands, RAST members turned to major international contests, which enabled a maximum number of QSOs to be sustained in short bursts of activity, in each case seeking and winning operating permission from the authorities.

The new regulations, effective this year, include:

- Only Thai nationals, 15 or older will be eligible
- Qualified foreign residents will be able to apply, but only under reciprocal operating privilege agreements (I believe the US, Spain, and Chile have already lodged requests with the Thai Ministry of Foreign Affairs—the agency that handles this matter)
- A National Security Council or Police clearance will be required, as will membership in RAST
- Three classes of licenses are allowed: Novice, offering VHF only on 2 meters; a Secondary HF class with Morse code requirement and better technical knowledge; and a First Class license with Morse code requirement and more technical know-how.

The Thai P & T Department is very keen on reciprocal licensing, so RAST will be grateful for any help which can be given to encourage the appropriate national administrations to communicate with the Ministry of Foreign Affairs accordingly.

Thailand will host the SEANET convention this year, November 11-13. Please spread the word for us, since we have no HF operations yet! SEANET meets at 14.320 MHz at 1200 UTC. I will write program details when I know them.

RAST has a new committee we believe will be in an excellent position to do its best for the amateur radio service in Thailand. It is headed by the Permanent Secretary to the Communications Ministry, a long-term amateur radio enthusiast, Sribhumi Sukhanetr HS1SS, and includes several senior officials in the PTT in appointed or advisory positions. 1st and 2nd Vice Presidents are Thavom Yaowakun and Mayuree Chotikul; Lt. Chamlong Chuathai is Secretary-general, Hans Hollstein is Assistant secretary; Treasurer is Rasdaporn Boonpitak, and in charge of public relations is Lt. Col. Prasit Neelayaothin.

Number 38 on your Feedback card

QTH DX

QTH is Cambodia

Leon Fletcher N6HYK
274 Webster Dr.
Ben Lomond CA 95005

For centuries, the country has been known as Cambodia. Many recent OSL cards still call it that. Both the United Nations and *The World Almanac* continue to call it Cambodia. But now the land is called Kampuchea. Cambodia is a country with even its name in conflict.

By whatever name, Cambodia is one of the most desirable countries to the typical DXer in the world. Consider these two points:

•Cambodia is the 18th most needed country, according to the latest study of "Most Wanted Survey" conducted by *The DX Bulletin* in July 1987.

•Exactly half of the nearly 1,000 DXers who reported their "wanted countries" to that study need Cambodia.

The typical Cambodian (and anyone else familiar with the country), however, who takes a look at the nation focuses on much different issues. The country suffers from widespread malnutrition, prevalent infectious diseases, especially malaria, inadequate roads, inconsequential manufacturing and other industries of negligible importance.

These are the words from no less an authority than the *Encyclopedia Britannica*.

Other observers, from field reporters to academic authors, point to equally depressing deficiencies. Even in the country's capital, Pnom Penh, most residents continue to haul water in buckets from communal taps. Piles of garbage line the streets. Key government and business buildings damaged more than ten years ago are still roofless. During the last few years, vandalism and looting have ruined classic temples dating from the eighth century.

Cambodians are exceedingly poor; the average citizen earns about $100 per year. And the prospects for improvement are not good. The number of agricultural technicians dropped from an already meager 1,400 to only 200 in the last decade. Only ten of these technicians have had graduate training. In a country of 6.3 million people, there are only 700 autos and 7,000 telephones.

The country's only daily newspaper is published by the army. Even so, more than half the people can't read or write anyway.

Further, Cambodia rates amongst the highest in deaths from political voilence in the world. *The 1988 World Almanac* details 177 nations. It lists Cambodia as the only country whose government has "no single authority (that) controls the whole country." The country, however, continues to be represented in the United Nations by a government thrown out of office, and out of country, nine years ago.

A village QSL from one of the Cambodian "back-pack" hams.

Through all that, and more, hamming still goes on.

Why?

In such impoverished, inadequate, inferior conditions, why would people bother to take the time, and the risks, to ham?

> ***"Cambodia is a country with even its name in conflict."***

According to talk on the bands, Cambodian hams are trying to stay on the air to be ready for either of two possible futures of their nation. In case a "final" government encourages an open society, Cambodians will need hams for worldwide communications, especially in the reconstruction period. If a "final" restrictive government takes over and shuts off Cambodia from the rest of the world, the country's hams must stay ready for surreptitious operation to keep the world informed of their nation's developments. The latter case is how hamming in Cambodia works today.

Although the country is about the size of Missouri and has roughly the population of New Jersey, there are only six hams listed in this year's *Callbook*. They're identified by call signs only. No names are listed. No Cambodian addresses are given. There are reportedly only three sets of ham gear in the country. Japanese DXpeditions apparently left two of these set there years ago.

The occasional signals sent from Cambodia are reportedly from hams who must move their stations from village to village every few days, leading an observer to term it "Backpack hamming."

The hams, along with most residents, are constantly on the lookout against various hostile forces. There are resistance fighters backed by the United States, China, and non-Communist Asian countries. The Soviet Union supports opponent resistance fighters. Enemy troops cross the border from neighboring Vietnam. Add to all this attacks from common thugs and thieves.

French missionary Francois Ponchaud in his book *Cambodia: Year Zero* describes the problems with which hams and locals have to cope. He quotes a Cambodian's explanation of how to get past the gangs of soldiers who set up roadblocks:

"To get from one place to another we had to have a mission order or a *laissez-passer* (a permit to pass). A lot of the Khmer Rouge (soldiers) didn't know how to read and those who could write did so very badly, so we wrote our own *laissez-passers*, trying to make them as illegible as possible. At Prek Kdam I showed mine to a Khmer Rouge who was on guard there. He looked at it upside down, glared at me, and said, 'All right, go on!'"

Today, few outsiders visit the country. Those who do often encounter grisly sights such as the infamous "pits of death"—giant mass graves. They are estimated to hold the remains of one to three million people. Award-winning British writer William Shawcross, in one of his books on Cambodia, *The Quality of Mercy*, tells about visiting one of the several mass graves located just a short distance from the center of Cambodia's capital city:

"Several hundred skulls had been neatly piled together. Femurs and limbs were in separate piles. Many of the wrists were still bound together with cord or wire, as they had been when the people were forced to kneel on the edge of the pits while Khmer Rouge soldiers clubbed them in the back of the neck . . . Flesh still clung to the hip joints and its terrible sweet-sour smell hung over the fields, so thick as to be almost a pall."

Cambodia is certainly a choice DX contact. It is also a very good thing, though, that amateur radio can help make the rest of the world more aware of the conditions inside this beleaguered nation. 73

Number 39 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

JULY PROPAGATION FORECAST

July is likely to furnish a mixed bag of propagation for DXers.

The first and last weeks of the month are likely to be quite good, while the middle two weeks will exhibit only fair to poor conditions.

On the days when the Solar Flux index is over about 125 and the Planetary A index is below about 5, DX should be exceptionally good. The HF bands will stay open well after dark, but seasonal noise levels will create difficulty on 40 and 80 meters, due to thunderstorms and static.

Stay tuned into WWV (10 MHz is usually the best bet) for the solar and terrestrial conditions, report at 18 minutes after each hour.

On the days when the magnetic field is unsettled to active, east-west propagation paths will be difficult, but occasional good openings on north-south paths are likely. Signals will exhibit typical "arctic flutter"; hollow and ringing sounds.

JULY

SUN	MON	TUE	WED	THU	FRI	SAT
					1 F	2 F-G
3 G	4 G	5 G	6 G	7 G	8 G	9 G
10 G-F	11 F	12 F-G	13 G	14 F-P	15 P	16 F
17 F-P	18 P	19 P	20 P	21 P	22 P-F	23 F-G
24 G 31 G	25 G	26 G	27 G-F	28 F	29 G	30 G

F = Fair
G = Good
P = Poor

Note Trends

Short-range sporadic E openings on 10, 12, and 15 meter bands are very likely this month, with excellent signal strengths and abrupt changes.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	--	--	--	--	--	--	20	--	--	--	--	--
ARGENTINA	20	20	20	40D	40D	--	--	--	--	--	10	15
AUSTRALIA	--	--	--	20	20	40D	20D	20D	--	--	--	--
CANAL ZONE	15	20	20	--	--	--	20	20	20	--	10D	15
ENGLAND	20	--	40/80	40/80	--	--	--	--	--	20	20	20
HAWAII	15D	20	20	20	40D	40D	--	--	--	--	--	15D
INDIA	20D	20D	--	--	--	--	--	--	--	--	--	--
JAPAN	--	--	--	--	--	--	20	--	--	--	--	--
MEXICO	15	20	20	--	--	--	20	20	20	--	10D	15
PHILIPPINES	--	--	--	--	--	--	20D	--	--	--	--	--
PUERTO RICO	15	20	20	--	--	--	20	20	20	--	10D	15
SOUTH AFRICA	--	40	40	20D	20D	--	--	--	--	--	20D	20D
U.S.S.R.	20	20/40	20/40	--	--	--	--	--	--	--	20	20
WEST COAST	40	80	--	--	--	--	--	20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	--	--	20D	--	--	40D	--	20	--	--	--	--
ARGENTINA	20/40	20/40	20	40D	--	--	--	15	15	15	[illegible]	20
AUSTRALIA	20D	[illegible]	[illegible]	20	20	40D	20	20	--	--	15D	[illegible]
CANAL ZONE	20	20	20	40D	40D	--	20	20	15/20	15	[illegible]	[illegible]
ENGLAND	20	--	40D	40D	--	--	20D	20D	--	--	15	20
HAWAII	15	15	20	20	20	40D	20	20	--	--	--	15D
INDIA	20D	20D	--	--	--	--	20D	20D	--	--	--	--
JAPAN	--	--	20D	--	--	40D	--	20	--	--	--	--
MEXICO	20	20	20	40D	40D	--	20	20	15/20	15	10D	10D
PHILIPPINES	--	--	--	--	--	--	20D	10D	--	--	--	--
PUERTO RICO	20	20	20	--	--	--	20	20	15/20	15	20D	15D
SOUTH AFRICA	--	--	40D	20D	20D	--	--	--	--	--	--	--
U.S.S.R	--	--	--	--	--	--	20D	20D	--	--	--	--

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	--	--	--	20	20	20D	40D	10D	10D	--	--	--
ARGENTINA	15	20D	20	20	--	--	--	20D	--	--	--	15
AUSTRALIA	15	15	15	20	20	20/40	40	20/40	--	--	--	--
CANAL ZONE	10D	15	20	20	40D	40D	--	20	20	--	15	10D
ENGLAND	20	20	20D	--	--	--	--	20D	--	--	--	20D
HAWAII	15	15	15/20	20	20	20/40	40/80	--	20	--	[illegible]	15
INDIA	--	--	20D	20D		--	--	20D	20D	--	--	--
JAPAN	--	--	--	20	20	20D	40D	20D	20D	--	--	--
MEXICO	10D	15	20	20	40D	40D	--	20	20	--	15	10D
PHILIPPINES	--	--	--	20D	20D	--	--	20D	20D	--	--	--
PUERTO RICO	10D	15	20	20	40D	40D	--	20	20	--	15	10D
SOUTH AFRICA	--	--	--	20D	20D	--	--	--	--	--	--	--
U.S.S.R.	20D	20D	20D	--	--	--	--	20D	--	--	--	--
EAST COAST	40	80	--	--	--	--	--	20	20	20	15	40

The band openings are for June, July and August. Note that a (D) will indicate a difficult path. Try on days when the geomagnetic field is quiet (G) and when solar flux is 100 and greater.

More VHF Propagation Modes

Most communication at HF is via the F region of the ionosphere, its highest ionized layer. With increasing sunspot activity and higher ionization levels, the F2 layer will begin to support worldwide propagation on ten meters and above. In fact, earlier sunspot cycles have shown the F2 maximum usable frequency (MUF) can exceed 70-75 MHz! Six meter DX may reach an all-time high with the current solar cycle if predictions come true.

Even when the higher HF bands are relatively quiet, there is often favorable north-south propagation, say between the North and South America or between Europe and Africa. Increased solar activity will bring transequatorial (TE) propagation at MUFs even higher than supported by the F2 layer. TE usually occurs within a 2500-3000 mile region north and south of the equator. Under optimum conditions TE will provide openings at least as high as 450 MHz!

May, June, and July are popular VHF DX months in the northern hemisphere due to the Sporadic E (E_S). Relatively localized patches of ionization occur within the E region, which lies below the F region. E_S is most common within the equatorial latitudes, but late spring and early summer show increased activity at higher latitudes. At 15 and 10 meters, single hop E_S will cover approximately 1300 miles. Of course, multiple hops can increase this distance to several thousand miles. Sporadic E is very good for six meter propagation, and many VHFers have successfully made contact on 144 MHz. Apparently, E_S does not support propagation very well above two meters.

Residents outside of the equatorial latitudes know auroral propagation all too well. During these disturbances of the ionosphere and magnetosphere, weak, garbled HF signals provide a tip to auroral activity. Signal distortion, which makes a voice signal sound much like the sender is gargling, is caused by the rapid variations of ion density. The shimmering visual effect of aurora is similar to what happens with radio waves. Because of the distortion, CW may be the only reliable mode for communications via aurora. Aurora are rare below 35° latitude. They will, however, support propagation over 1200 miles at frequencies greater than 450 MHz.

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A Lost Art?

Q: How much do hams nowadays indulge in "home-brewing"—the practice of building, testing, and troubleshooting their own radio equipment? What are the benefits?

A: Home-brewing is enormously popular, even in this age of the ready-made-just-add-juice amateur radio station. Though we include at least a few such articles in every issue, the most consistent remark on *73*'s reader feedback cards is "more construction projects." It's no longer imperative to home-brew, but, as many hams see, it adds a huge dimension to the hobby. Read on to find out why!

Home-brewing is Alive and Well

Building, testing, and individual innovation thrives for these reasons:

•Amateur radio technology has blossomed. There are many more avenues to explore and refine—plenty of room for both commercial and individual development.

•Cost. Kits are often cheaper than the assembled product. Most of the commercial amateur equipment is made in Japan. The strong yen/weak dollar has driven the prices of transceivers to unseemly levels. For example, a particular series of **VHF** and **UHF single-band** transceivers, now retail for $1400 each! In this particular case, many hams are buying **transverter** kits to build and install on their **HF rigs**, cutting their costs by many hundreds of dollars.

•Transceiver technology is by far the most involved. Other elements of the ham station—such as the **linear amplifier**, the **antenna system** and the **antenna tuner**—remain relatively simple and comprehensible to the dedicated hobbyist. You can easily and relatively cheaply put together these three items at near state-of-the-art levels.

•Radio frequency spectrum crowding. There are several million hams in the world today. The push is on once again to fit a signal into a smaller **bandwidth**. Many hams, as well as commercial interests, are now working on this. There is a lot of work being done now with **digital** and **synchrony** techniques toward this end.

•Simple troubleshooting often saves much time and money. The **Volt-Ohm-Meter** (VOM) is the most useful shack test instrument. It's able to perform a bevy of simple tests. It can check to see whether a circuit is open (broken) or shorted (contacted with another circuit). It can also check a transceiver's **power supply**, which is a relatively simple circuit, and often a trouble source. It can also make at least some kind of test on most electronic components.

Finally, there's the deep satisfaction of operating a piece of equipment you've built yourself. You can't help but feel closer to the hobby, and you can't *not* help learning a great deal! 73

. . de NS1B

GLOSSARY

Antenna system—All the components of a radio station to which a transmitted signal from a transceiver goes. It's most basic form has only two parts: the transmission line, which carries the signal to the antenna, and the antenna which radiates the signal into the atmosphere. The transmission line should allow as little of the signal as possible to radiate from it, in order to get as much of the signal as possible to the antenna.

Antenna tuner—This device matches the antenna system to the transceiver. A poorly matched system results in a lot of the output power from the transceiver being reflected to the transceiver by the antenna system. The tuner has two principal aims: to allow the antenna to radiate as much as possible, and to prevent as much signal energy as possible from returning to the transceiver.

Band—A range of frequencies in the electromagnetic spectrum, as in the AM broadcast band. Collections of bands are further grouped into subspectra. Examples of these are: High Frequency (HF), Very High Frequency (VHF), Ultra High Frequency (UHF).

Bandwidth—This usually refers to the amount of frequency range a signal occupies.

Digital—Information in this mode is represented in a limited number of discrete units. Morse Code, for example, conveys information using only five units—"dihs"(dots) and "dahs" (dashes), and spaces of three different lengths.

Federal Communications Commission (FCC)—This is the US government agency responsible for the allocation of frequencies for radiocommunications and broadcasting in the US.

Ham—Short for "amateur radio operator."

Linear amplifier—The device that takes a signal from a transceiver and increases its power before sending it to the antenna system.

Modes—Mode has many meanings, but here it refers to the form the information is packaged in on an electromagnetic wave. Examples of such modes are: amplitude modulation (AM), frequency modulation (FM), single side-band (SSB), and continuous wave (CW), which is more commonly known as Morse code.

Power supply—This is the circuit that converts the electrical current from the wall sockets in homes into a form the piece of equipment can use.

Radio frequency spectrum—The portion of the electromagnetic wave spectrum which covers waves whose wavelengths range from 30 kilometers to 1 millimeter. The corresponding frequencies are 10,000 cycles/second (10 kHz) to 3000 billion cycles/second (3000 GHz).

Rig—Jargon for transceiver.

Single-band—A transceiver that operates on only one band of frequencies.

Synchrony—Sychronous modes are those where the two stations in communication use the same timing cycle.

Transceiver—A transmitter and receiver combined in a single unit.

Transverter—A device that allows a transceiver to to operate on a range of frequencies different from the transceiver design.

Volt-Ohm-Milliammeter (VOM)—A device that measures the three most common electrical quantities—resistance (in units of Ohms), voltage (in units of Volts), and current (in units of Amperes).

QRM

Editorial Offices
WGE Center
Peterborough NH 03458-1194
phone: 603-525-4201

Advertising Offices
WGE Center
Peterborough NH 03458-1194
phone: 800-225-5083

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Contractual Agreement: Don't blame us. You did it! You opened this magazine, and now you have to abide by the terms of this contract. First of all, you must agree to help us promote amateur radio. Invite the local scout troop over for a demonstration, go talk to your computer user's group about radio, impress your golfing buddies with an autopatch from the 17th tee, or even help some of your shuffleboard cronies get on the air. Next, you have to correspond regularly with the editors and Wayne. Tell us what you like and don't like about the magazine. There's no escape, so you might as well enjoy your new responsibilities.

73 AMATEUR RADIO

AUGUST 1988 — Issue # 335

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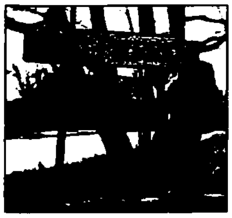
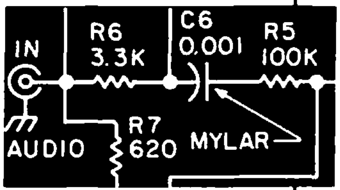


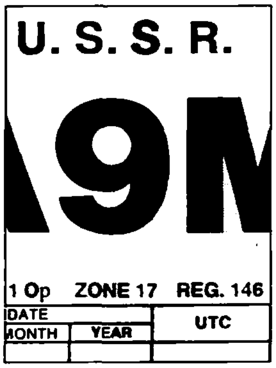


REVIEWS

DEPARTMENTS

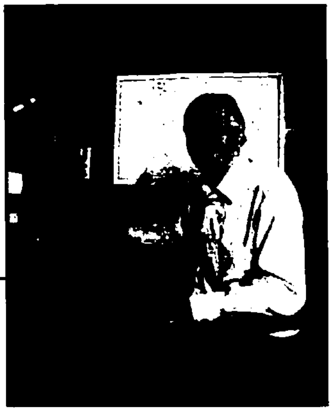
FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 81. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

Cover by Deborah Smith
Photography by Suzanne Torsheya



Number 2 on your Feedback card

NEVER SAY DIE



DAYTON!

Too bad if you screwed up and didn't make Dayton. I started going 33 years ago and have missed only few years since.

The Hamvention was its usual madhouse, with hundreds of inside commercial exhibits and zillions of flea marketers outside. The weather couldn't have been better.

Another Rouser

My talk was well-attended again—SRO. Despite the heat given off by an estimated 70 tons of warm ham, very few fell asleep. The Hamvention people tell me I pull the biggest crowd of all at my talks. That's good for my ego . . . which could use some plumping up now and then.

Now, I suppose since you didn't bother to come and hear me, you're going to want to know what I talked about. Lotta things. Fortunately, no one made a tape, so nobody can prove anything. Heh.

Ham Clubs Too Cliquish

I remember telling about a talk I'd given just a few days before at Nichols College. When I mentioned amateur radio to the students I got the fish eye—most of 'em had never even heard of amateur radio. Is it something like CB?

Look here, you turkeys, at the next meeting of your club you appoint someone as the PR coordinator and you charge 'um with making sure that anything and everything your club or any member does of even remote interest is written up and submitted to your local papers and broadcast station. We're going to get the general public informed about amateur radio if it kills you.

While I'm on you about your crummy, do-nothing ham club and the terrible fix you've gotten us in by being lazy about PR, let me assure you that I'm still getting letters from all over the country from youngsters telling me how hostile your club is when they come to a meeting. Give me a break!

Stop that baloney and start getting kids to come to your meetings—and make the meetings fun for them. Got that? If you don't know how to deal with a ten-year-old Novice or potential Novice, find out and clean up your act. Your club meetings are supposed to be for the benefit of all the members, not just two or three fat old men with serious ego problems. Got that?

You say that your ham club isn't crummy, that you do, too, have youngsters coming to meetings? Oh, yeah? Well, prove it. Send me a picture of your next club meeting with those youngsters showing where I can see them. Send me some pictures of the Novices your club has gotten licensed. Put some photos where your mouth is.

Take That!

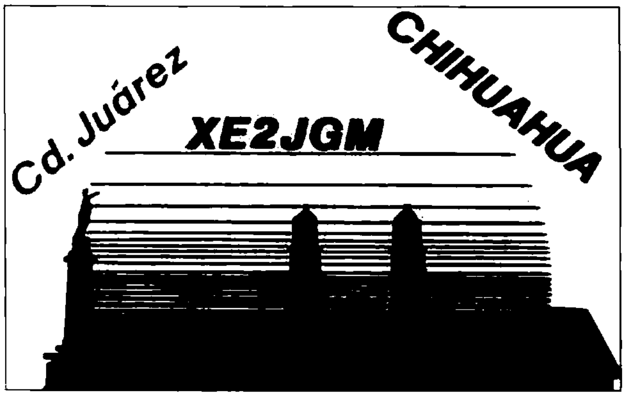
Now, Dayton . . . oh yes, I mentioned the recent Canadian government proposal for a no-code license. That ought to blow the lid off things. This one seems most likely to go through, which means the pressure will be on again here in America for a no-code license. I love it.

I explained for the umteenth time that while I favor getting rid of the code as a requirement for a ham license, I have always tied this to a more demanding technical exam. I have this crazy notion that amateur radio should be a technical hobby, not one of skill.

Indeed, I believe we'll find here in America, as they have in Japan, where they'd had the no-code license for many years, that a great many amateurs become proficient at the code for the fun it offers. If we ever get rid of the code requirement in America, you may be sure that I'll have a series of code proficiency certificates available in short order. I'd like to see one of the major activities at hamfests the administration of code speed contests, with award certificates for the hamshack wall.

I explained, too, that it's as easy to learn the code at 13 words per

Continued on page 39



QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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Editorial Offices
WGE Center
Peterborough, NH 03458-1194
603-525-4201

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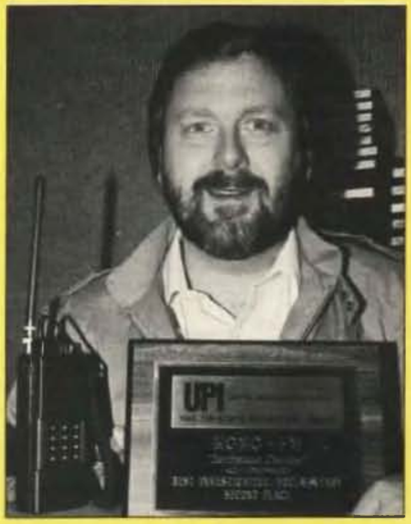
QRX . . .

EDITED BY BRYAN HASTINGS KA1HY

Mission Accomplished

Canadian and Soviet Polar Bridge Skiers completed their 2000 km trek on June 1st. At 1435 UTC, the 13 arctic explorers reached Canadian shores in good health after three months crossing the north polar ice cap from the USSR. Dr. Dmitry Shparo UA3AJH, expedition leader, eight other Soviets and four Canadians were assisted by HF and satellite amateur radio communications throughout their trip. The success of the polar trek depended largely on the cooperative spirit between Canada and the USSR as well as the effectiveness of amateur communications. Congratulations to all participants. Watch for a detailed story of the polar trek in a future *73*.



Broadcaster and Ham Steven Sellers N5GZP recently received an award from the United Press International for the "Best Investigative Documentary." The honor was awarded for a one-half hour program that Steve had written, produced and reported, entitled "Earthquake Country." This was broadcast over San Diego radio station KGMG-FM where he is news director.

Trajectoire Nominale!

That's right. . .the Ariane 4 rocket carrying Phase 3C and two other satellites was successfully launched 15 June at 11:19:01 UTC, 6 minutes later than planned. The weather was perfect and the rocket functioned flawlessly, putting all three satellites into orbit. Approximately three hours after lift-off, Ian ZL1AOX was able to receive OSCAR 13's beacon very strongly and decoded the telemetry error-free. He commanded the satellite to switch telemetry to the engineering beacon to verify that command is possible. Stations in South Africa, Italy and Israel also reported hearing the beacon.

The telemetry from OSCAR 13 indicates a perfect orientation and a spin rate of 7 RPM. All important telemetry values are quite satisfactory.

The next events are the precise determination of the actual orbit and raising the perigee to a safer altitude.

Amateurs who are unable to hear the general beacon on 145.812 MHz should listen for the engineering beacon on 145.985 MHz.

No Longer Just "QSL via Box 88"

Glasnost **("openness") is filtering down to Soviet Amateur radio.** Gennady UA9MA, *73's* USSR correspondent, recently attended the All-Union Amateur radio conference in the Soviet Union in Moscow 9–10 April. He sends *73* these four revisions:

1) Foreigners may now QSL direct to USSR hams, who likewise may also QSL direct out of the country.

2) USSR hams may print their pictures and addresses on their QSL cards.

3) USSR hams may now publish their addresses in any callbooks.

4) USSR hams may now QSO with Israeli stations.

All this is a promising start. Is reciprocal licensing just around the corner? See "73 International" for details.

Fore or Aft?

In response to a petition filed by the ARRL, the FCC amended Part 97 amateur regulations to permit foreign operators under reciprocal operating agreement to put their location prefix ahead of their callsign when identifying. In its petition, the ARRL claimed that this identification method had already been endorsed by the International Amateur Radio Union (IARU) and that many nations worldwide had already inplemented it.

By way of example, an operator from Australia visiting Florida who in the past had signed VK3BKL/W4 will now identify as W4/VK3BKL.

"I don't do anything much! He calls CQ and answers all questions!"

Australian VEC!

Australia now has its own all-volunteer amateur radio testing program. This puts an end to the quarterly and very expensive ($30 Australian) testing program. VEs may hold exams as often as they wish. Examination fees are left to marketplace forces.

Australia adopted *none* of the restrictions of the United States all-volunteer testing program. Those under 18 years of age, persons in commercial industries allied to amateur radio, and hams of any license class will also be eligible. In some cases, the Australian Department of Transport and Communications (DOTC) will accept as examiners even those without ham licenses, such as members of technical colleges.

Even a single examiner is allowed to give any class of test if he or she posts the exam date with the DOTC in advance and notifies the DOTC in advance of any unscheduled examination sessions.

Australian Novice class operators also have the use of two meter FM. Prior to June 1, Australian Novices were restricted to CW, AM, and SSB, on segments of the 80, 15 and 10 meter bands. Now, they can also operate 146–148 MHz at 10 watts FM. 146–148 MHz is the Australian FM repeater subband.

Pappy is SK

Bandel "Pappy" Linn K4PP, a distinguished cartoon illustrator and well-known radio personality, passed away on 7 May, at age 76. Bandel's cartoons appeared in a host of national magazines, including the *Saturday Evening Post*, *Colliers*, *Cosmopolitan*, and the *New Yorker*. *73 Magazine* had the good fortune to run Bandel's cartoon series, "Well. . . I Can Dream, Can't I?," from the the early 80s, until ill health compelled Bandel to stop. *73* regrets the passing of one of amateur radio's more illustrious members.

Thanks To . . .

UA9MA, VK2BVS, WA6WZO, K8TMK, the *Herald Palladium* of Benton Harbor, Mich, and *Westlink Report* for this month's news items. Send news items and photos to: *73 Magazine*, WGE Center, 70 Rt. 202 N., Peterborough, NH 03458, Attn: QRX.

Holy Mackerel, What A Mess

FP/W2NSD DXpedition

It sounded like hundreds of stations calling when I stood by! I couldn't make out anyone's call. Is there a greater excitement in amateur radio than being on the hot-seat end of a DXpedition?

The *73* crew—Larry, Bryan, and I—headed to St. Pierre (FP/W2NSD) over the Memorial Day weekend. What an incredible weekend it was! And what a magnificent DX location. It has everything. It's easy to get to—we flew there. It's inexpensive. And it's located so the propagation into the U.S. couldn't be much better.

Where's St. Pierre? It's a tiny French island right below Newfoundland. Check it out on an atlas or globe. It's even on the *73* World DX Map.

We started from New Hampshire on Wednesday, flying from Boston to Halifax that day. There were no connections to St. Pierre until the next morning, so we met with the local Nova Scotia hams at the Airport Hotel that evening. Despite the hotel being about 20 miles out f Halifax, around 60 hams turned out.

I put on a W2NSD performance for about an hour, convincing some very hard-bitten dyed-in-the-wool CW fanatics that no-code was the way to go. Talk about a challenge! As usual, I talked about everything under the sun as well as amateur radio.

The next morning the weather was lousy, so the flight was delayed. And delayed. And delayed. After five one-hour delays the flight was finally cancelled. "Come back tomorrow." Time to spare, go by air. Oh well, I suppose it's still better than an 18-hour boat trip.

At Last

On Friday morning the weather was beautiful, so we got off on schedule, an hour and a quarter flight. St. Pierre immigration and customs were no problem, even with all our big suitcases of ham gear. We had along six large heavy aluminum suitcases.

We took a taxi into town, about a kilometer. This is a very small island. Hotel Robert is right smack-dab in the middle of the downtown area. The Annex (40 rooms) faced the town square. Being early in the season, we were the only ones using the Annex. Fine, we could make all the noise we wanted. Planning ahead, I brought earplugs so I'd be able to sleep through the din. This turned out to be a shrewd safeguard. I needed 'em.

Room 36 came complete with coax connectors going to a defunct minibeam and a vertical on the roof. We set up our three rigs, using the ICOM 761 as the main station.

After a few dozen CQs and distressingly few contacts I began to suspect that the minibeam lacked a little in effectiveness. I tried rotating it and found no change in signal strengths. Hmm. It was merely a lump and what signals were sneaking out were probably coming from the coax feedline, not the "antenna."

Photo A. Was Wayne really there? Here's proof for skeptics.

Fortunately Bryan had brought an emergency dipole. Once that was up we began to seriously fill the log sheets. The pileups sure did get the adrenaline going. What a high! My experience operating from other rare spots made it possible for me to whup down the piles quickly, right on down to the weakest mobiles and QRP callers. Hams don't need a kilowatt to work W2NSD, no matter where I am in the world, just some patience, and not even a lot of that.

Photo B. Many homes on St. Pierre are colorful. The weather couldn t have been nicer—4c (40 F) at night and up to 18 C (66 F) during the day.

Working Pile-ups a la W2NSD

Here's my speed system for working pile-ups. I call CQ long enough to get the attention of any stations that may be breaking in on my frequency. Then, before standing by and facing ten minutes of pure hell, I tell the assembled throng that I will be listening for the last two letters of their call only. I want one call, and wait a bit. Space it out so I can write down the two letters. Constant breakers get no QSL. Yes, I get downright mean when my adrenaline is going strong.

Then, as I sort out the two letters I repeat them and ask the caller to stand by. This goes on until the channel is completely clear. About halfway down the stack I start getting breakers wondering who the DX is on frequency, so after about ten are stacked up it's time to make another short general announcement with my call and the rules. Then I keep on getting the last two letters of the callers, asking each in turn to stand by. Finally I get down to the noise level, then the mobiles and QRP ops. I've worked 1/100-watt stations right along with the multi-kilowatts.

When I have all the callers written down on a worksheet it's time for the complete exchanges. First I give the QSL information, then I start down my list, giving each their signal report and their two letters. Five-nine. I stand by and log the whole call and my report. Then I repeat back the call and received report as my acknowledgement (QSL) and go immediately to the next caller, giving his or her report.

If I wait until after I have their call to give them a report I'm going to have two more transmissions—and the potential of presenting a long-winded op who can't prevent himself from telling me his location, name, rig, antenna, microphone and so on—an opportunity he can't pass up. Geeze!

All I'm looking for are the call letters and report. That's all it takes for the QSL card, so why waste my time on names and other trivia? I'm not there for rag chewing. I'm there to give as many ops a QSL as is inhumanly possible during my few hours on the air. And don't forget it.

Special Point of View

I realize that after years of automatically and unthinkingly swapping names, QTHs, rigs, antennas and so on, it's difficult to get into a DXpedition frame of reference. The ops contacting me want to know I have their call right and they want their signal report. They also want to know where to send their QSL card. Ops in Russia often won't let go without getting a name in their log; it must be a government regulation, with heavy gulag time for those who don't get a name.

By the way, it sure helps to write down the information you're going to give. There's no problem remembering it the first few hours, but by 2 a.m. you have to look at your cue sheet to remember your own call. Oh yes, use a pencil for log entry. You're going to make lotsa mistakes.

Other than being easy to reach, friendly, a great radio location and inexpensive, St. Pierre doesn't have a lot of plusses. Bryan and I rented bicycles ($4/hr) and pretty much covered the island in a couple hours. Don't miss the elephant train two-hour tourist tour on Sundays.

The local language is French, but most of the people who come into contact with visitors speak English. After all, St. Pierre is surrounded by English-speaking countries. I didn't notice the usual French arrogance either, which was nice.

The hotel continental breakfasts come with the room: very buttery, delicate croissants, coffee (or tea), butter and jam. In season people can get other meals at the hotel or at any of the many other restaurants and snack bars. We loaded up on cheese, crackers, fruit and sausage at a local grocery so we wouldn't have to stop operating for a two-hour lunch. They even sell bananas there, which is more than one can say for the USSR.

St. Pierre's heydays were from 1922–33, when they were making zillions as a rum-running stop between Scotland and the US. Old whiskey crates are the decorative motif here. Since then they've been living mostly from fishing and hand-outs from France. If we can get a small DXpedition business going it'll help 'em out. I'll bet we can get 'em to issue some special DXpedition calls too. How about FP73A and so on?

Loggings

What did we work? Well, tons of W/K/N, of course. Plus loads of G's, Russians, LA, SM/K, OH, OZ, DL, Y88, ON, PA, EA, OE, YU, OK, SP, LZ, YO, PY, LU, YV. One African 5Z4, nothing from the middle east. Most of the ops in the rarer countries were busy with their own pileups, so we never heard each other. I heard the piles now and then as I tuned the band, but I wasn't anxious to spend a half hour or more in a pileup; and few DX ops are very fast. Most of 'em just stand by and try to pick out the loudest caller. This keeps the QRM level high and the contacts down to one every minute or so instead of three or four a minute average. Without a powerhouse signal I knew I'd just waste my time chasing DX, and that wasn't why I was there. I was there to be chased.

Of course, if more DX ops would use my system for working 'em right down to QRP, most of us would have more countries worked and wouldn't get as fed up with the whole danged thing.

One secret for building a pileup—it takes a pileup to attract contacts—is to call CQ with a very excited voice. Call it fast and feverish as if calling a rare one yourself. That'll get 'em as they tune across the band. Raise your voice—call fast and furious.

Photo C. Bryan FP/KA1HY racks 'em up with the ICOM 761 on 14.165. Note the Koss stereophones—why not go first class, eh? The Oreos are for Wayne.

I've DXed from some rare spots—Navassa Island (KC4) in '58 and '72, Jordan in '70 and '73, a whole bunch in '59 and '66, so I'm familiar with pileups. I'll tell you this: No one ever forgets a single minute of any DXpedition they go on. It's an experience you'll always treasure.

Photo D. FP/W2NSD looking jealously while FP5DF makes a contact.

Club DX

It was so simple getting to St. Pierre and operating and so inexpensive. I got to talking with Larry and Bryan about maybe setting up a DXpedition club—Club DX, Larry christened it—to make it so you, too, can get on and enjoy the pileups trying to work you, so you can have the time of your life.

What would it cost to set up a first class ham station up there? I'll bet we could put in an all-band rig, a linear, a beam, a vertical, RTTY, packet, SSTV and maybe even OSCAR for about $6,000. If we could keep it active 100 days a year we'd be able to cover the cost of the equipment and occasional repairs for maybe $50 a day. In that way, DXers wouldn't have to lug hundreds of pounds of rigs and antennas, keyers and so on. Heck, anyone could easily get up there, operating permit in hand, and be on the air instantly.

The hotel might run $500 for four days for a regular room plus the hamshack room, plus $350 air fare each from Boston. You could take the wife for a fantastic four day DXpedition for under $2,000. Going alone, you won't need the second plane ticket or room, you cheap old buzzard.

Alas, considering so many hams today are retired and living on fixed, meager incomes, perhaps there aren't enough red-blooded DXers to make it feasible to develop a dream DX site.

With the average ham age in the mid to high 50s, about half may be retired already. Judging from my contacts on the air recently over 90% of the active hams are retired. Also, judging from the stacks of letters from hams claiming to be too poverty-stricken to even be able to afford $20 for *73*, much as they'd like to, that also makes me wonder if there are enough hams with even the relatively small small investment it would take for a mini-DXpedition—even though it might be one of the most exciting ham experiences of their lives.

When I remember the pileups I handled from 5W4AZ (bet you have to look it up), from VR2FD, from 7P8CA, JY1 and JY8AA, YK1AA, YA1NSD, 5Z4, EP2, KS6, KW6, KR6, 9N1, 9M8, 9M6 . . . sigh. Even racking 'em up from KV4AA was a delight, and that was before I really knew how to handle the pileups fast.

If you do decide to get into the most exciting phase amateur radio has to offer, don't forget to take a camera and word processor. Your experience could bring some bucks from a ham magazine, perhaps even one of the regular consumer magazines such as *Geriatric Adventures, Trivia & Leisure* or *National Photographic*.

If there are enough hams who have not lost the spirit of adventure, whose flame of life isn't about flickered out, maybe we can get St. Pierre fired up. Heck, I could get similar sites going in a dozen other easy to reach, yet fairly rare countries, mostly in the Caribbean. Yes, it'll be hard work making the arrangements and testing out such sites, but no one said publishing a ham magazine was going to be easy.

Should I look for spots where you can combine hamming with skin diving? Or would you prefer to make the Silent Key list without ever being on the live end of a pileup? It's your life, your priorities.

AUTO-VIM
PART I

A Dual 5–15 Volt Bench Supply with Automatic Voltage and Current Monitors

by L.B. Cebik W4RNL

The advent of three and four pin monolithic voltage regulators in both fixed and variable voltage models for two dollars or less each has simplified the construction of bench supplies for the ham shack or experimenter's workshop. A few dollars and a few parts yield perfectly good supplies in the 5 to 15V range, which covers most building and testing needs. Current capabilities depend only on the particular regulator model and the size of the heat sink we choose. It's a snap now to build a well-regulated bench supply!

Challenges of Convenience

The new challenge of bench supplies is building in user conveniences. Voltage and current monitoring, for example, are extremely useful. A first glance at the problem, however, suggests the need for at least four meters: a positive voltmeter, a negative voltmeter, a positive ammeter, and a negative ammeter. If the ammeter is to cover more than one range–say, 50 mA and 500 mA full scale–then more manual switching is needed. Short of installing some autoranging, autopolarity DMMs inside the power supply case, the problem of comprehensive power supply monitoring seems either complex or expensive.

Far from it, however. A batch of inexpensive and easily accessible ICs and transistors, along with a few resistors and fewer capacitors, gives comprehensive voltage and current monitoring for most small bench needs. This article describes a half amp bench supply with the following features:

- ± 5 to 15V output with mechanical tracking to within a few hundredths of a volt.
- Automatic voltage monitoring with electronic switching between plus and minus voltages and with manual override for close monitoring of one of the voltages.
- Automatic current monitoring with electronic switching between plus and minus supply loads, again with manual override for close monitoring of one of the current loads.
- Automatic current ranging between 50 mA and 500 mA full scale ranges, regardless of voltage polarity.
- A parts cost of about fifty dollars or less.

Auto-VIM stands for AUTOmatic Voltage and current (I) Monitoring. In addition to providing circuit and construction details on this bench supply, this article supplies enough background to vary the circuits to personal needs. This includes the adaptation of the circuit for use with digital voltmeter circuits. For supply monitoring, I prefer analog meters, but preferences vary according to the type of work prescribed for the bench supplies. In addition, there's a one meter voltage and current monitoring circuit.

Basic Design Concept

The basic design of the power supply appears in Figure 1. Since the power supply itself is fairly standard, except for the secondary regulators, which feed a fixed ± 15V to the monitor circuits. A clock (555 or 7555) and flip-flop (4013) provide the control pulses for changing polarity in the two monitors. Connecting the Set and Reset pins of the D-type flip-flop to a switch allows the operator to override the clock and force the circuit to the high-low combination which permits reading either the positive or negative voltages and currents.

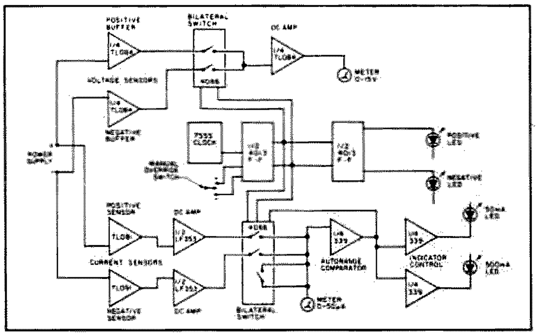


Figure 1. Block diagram of the voltage and current monitoring system.

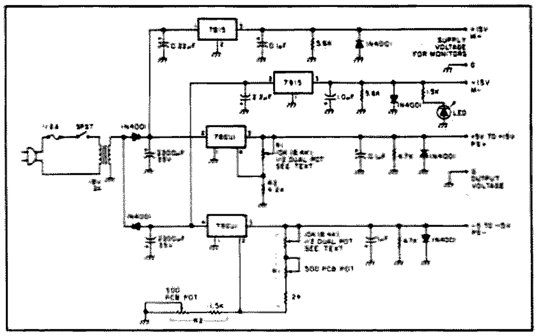


Figure 2. Schematic of the dual, variable power supply and fixed 15 V supplies.

The voltage monitor consists of a quad op amp (TL084) used to sense a set fraction of the supply voltage. A bilateral switch (4066) controlled by the flip-flop selects the output from the non-inverting unity gain buffer for positive voltages or the inverting buffer for negative voltages, thus providing succeeding stages with only positive voltages. A non-inverting DC amplifier raises the voltage to a maximum of 10V (well within the linear capabilities of the TL084) for readout by a modified 0-to-15V voltmeter whose external series resistor has been changed to track the DC amplifier output.

The current monitor uses the same flip-flop signals to control another bilateral switch (4066) which feeds voltages from the sensor input stages to the meter. The sensors use both normal Bi-FET (P-channel) and NFET (N-channel) op amps to sense the current drawn from the positive and negative supplies, respectively.

The TL081 and TL091 op amps feed a low level voltage proportional to the current to standard DC op amplifiers (LF353 dual op amp), with the negative voltage inverted so that the meter circuit sees only a positive voltage. Which current-proportional voltage the meter sees is controlled by the 4066. One section of a quad comparator (339) senses the voltage in the meter circuit. Above a certain point (1.2V), it switches in additional meter circuit resistors to increase the range by a factor of ten, thus giving automatic ranging between the 50 mA and 500 mA scales. Unused portions of the

4013 and 339 control panel LEDs indicate polarity and ammeter range.

Accuracy

Minor inaccuracies introduced by imbalances in the current sensing op amps and calibration errors limit the absolute precision with which the circuits will read out either voltages or currents. Current residuals depend upon the tracking accuracy of the positive and negative supplies, and are minimized by splitting DC amplifier duties between the sensors and the follow-up 353 stage. With careful mechanical adjustment of tracking, these reduce to 2 mA or less (apart from other sources of calibration error).

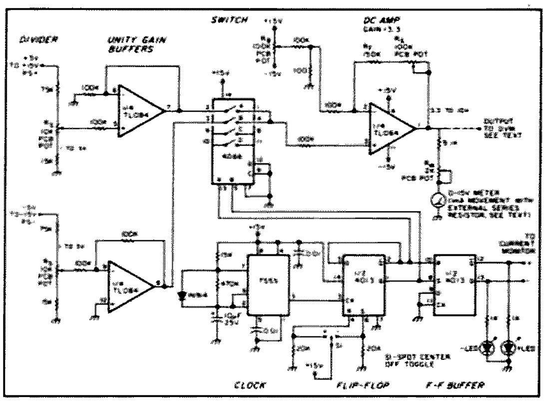


Figure 3. Schematic of the auto-polarity voltage monitor.

The accuracy of the voltage monitor depends upon the accuracy of the calibration results. Power supply monitors provide general indications rather than specific measurements of test circuit performance. The latter require more precise measurements with the usual array of test bench equipment. Therefore, an accuracy of 10% in general monitors is usually good enough, and 5% accuracy is more than most applications require. Careful construction and calibration permit these circuits to better the 5% mark plus or minus the inherent accuracy of the analog meters themselves (generally 2 to 3%). These figures suggest that the monitor can provide a valuable service to the builder and experimenter. In fact, it has already saved me nearly its own cost in components that did not die in test circuits.

Achieving good circuit results depends on careful component selection and calibration throughout the supply. Ordinary ham shack-VTVMs and DMMs are fine. In fact, the circuit requires only 5% tolerance components at its critical points, plus some care. The care contributes to the circuit's fairly low cost. In order to catch all the salient circuit features, let's explore the major circuit divisions one at a time.

Variable Dual Power Supply

Figure 2 shows the dual power supply that forms the core of the project. The supply is standard in almost every feature. The 18V, two amp transformer provides ample reserve capacity for the supply at peak loads, despite the simple half-wave rectifiers. The large filter capacitors minimize ripple to the regulators. Tracking with the 78G/79G series four pin regulators is quite simple, compared to others on the market. Moderate size heat sinks for the TO-202 packages will handle the supply's requirements. The remaining components are standard data book recommendations.

The 7815/7915 positive and negative fixed regulators provide the voltage for the monitor components. For the small load involved (under 20 mA exclusive of BEDs, which are set at about 10 mA each), Zener regulation might do, but the fixed three pin regulators are cheap, nearly foolproof, and run cool without heat sinks.

To establish the values of the control components R1 and R2, measure the actual value of the dual 10kΩ potentiometer. Most inexpensive varieties top out at less than 10kΩ. In my case, I found 8420Ω the maximum value. I obtained several pots and chose the unit whose individual maximum values were most nearly equal. The closer the values, the better the tracking of the two supplies.

The rest of the process is a matter of following data book formulas, with a few adjustments. For both regulators, the output voltage (Vo) equals the sum of R1 and R2 divided by R2, with the result multiplied by the control voltage (Vc). For the 78GU1, Vc is 5V, and for the 79GU1 it is 2.23V. The data books recommend a 1 mA control current, which gives 5kΩ and 2.2kΩ for the positive and negative regulator values of R2. With the less than nominal maximum pot value, however, (8420Ω instead of 10 k), 4.2kΩ yielded a positive output range from 5 to 15V with the 78GU1. Applying similar logic to the 79GU1 negative regulator gave a value of 1875Ω for R2 and a series resistor of 2345Ω for the potentiometer leg. Breaking the fixed values into fixed resistors and circuit board trimmer pots yielded the values in Figure 2.

The procedure for calculating the negative regulator values begins with the formula for R1, which equals R2 times the difference between the output voltage (Vo) and the control voltage (Vc), all divided by the control voltage. At minimum output (5V) when the potentiometer is also at minimum, R1 will be 1.25 R2, and at maximum voltage (15V) with the pot also at maximum, R1 will be 5.73 R2. Since the difference between R1 at maximum and minimum is 8400 Ω (the measured range of the pot), 5.73 R2 minus 1.25 R2 will also be 8400 Ω. R2 thus equals 8400 divided by 4.48 (i.e., 5.73 - 1.25), or 1875 Ω. A 1500 Ω fixed resistor plus a 500 ΩPC board trimmer give room for adjustment. Since R1 at minimum (when the pot is at 0 Ω) is 1.25 R2, which we just set at 1875 Ω, then the series resistance for the R1 pot leg of the control circuit will be 2345 Ω. A 2kΩ resistor plus a 500 Ω trimmer again provide room for adjustment.

Calibrating the tracking is easy. Check the positive supply range and later the 4.2kΩ resistor until the output extends from 5 to 15V. When the positive supply voltage range is satisfactory, then set both negative PC board trimmers to midrange. With the dual pot set to minimum value, adjust the trimmer in R2 to let the negative voltage equal the positive voltage (about 5V).

Turning the dual pot to maximum, adjust the trimmer in the R1 leg to let the maximum negative voltage equal the maximum positive voltage. Retrimming both the circuit board pots once more should yield stable results. Now output voltage tracking will depend on how well the dual pot sections track. Even with inexpensive dual pots, the variation should run less than a tenth of a volt between supplies. If the error is greater, but consistently high or low for one supply, then repeat the calibration. If the error varies across the voltage range, a different dual pot may be in order. Careful pot selection can thus save the cost of precision potentiometers and the complexity of electronic tracking circuitry.

As the photographs show, construction is not critical. Perfboard works very well when placing one set of stand-off pillars under the transformer mounting wings, rather than at the corners of the board. Use heat sink grease between the variable regulators and their finned sinks. Also note that the pinouts of corresponding positive and negative regulators differ. Do not let local QRM cause a reversal here! My experience says that at least one of the regulators will fry at first test.

My perfboard construction techniques make use of T-46 pins for off-board connections. In this project, there are many board-to-board and board-to-panel connections, so have a good supply of pins and plan their placement carefully. Since, as the photos show, the project will fill the case, be sure that no pins interfere with cabinet screws.

Voltage Monitor

The voltage monitor makes use of some automatic metering principles previously reported in *73*, but updates them to eliminate the need for measuring the forward voltage drop of diodes and for taking the drop into account when designing the power supply section. By using op amps to sense a portion of the positive and negative voltages, it's possible to control the voltage and not exceed the op amp limits, while still making accurate measurements. The trade-off for this convenience is the need to calibrate the circuit carefully.

As in the earlier voltmeter circuit, it begins with a timing clock (7555 or 555). The clock circuit provides short square wave pulses, as the on-time is controlled by the 15kΩ resistor. The diode shunts the 470kΩ resistor during capacitor charge, but the discharge goes through the resistor, extending the off-time to about 3 seconds. The 4013 flip-flop provides alternate 3 second periods for reading positive and negative values. The builder can alter the 470kΩ resistor to change the read periods, or insert a 500kΩ circuit board trimmer pot in series with a 330kΩ resistor to provide for an adjustable period.

The 4013 D-type flip-flop is in a standard divide-by-two circuit. Be sure to bypass pin 14 to ensure good action. Some combinations of clocks and flip-flops will miss some or even all beats without it. The extra portion of the two-section chip keys the indicator LEDs and provides clocking pulses to the current monitor. The Set and Reset pins (6 and 4) are grounded for clocked operation through 20kΩ resistors. Setting either high with the single pole, double throw, center off toggle switch will override the clock, locking the readout either positive or negative, along with its indicator LED.

If complement-Q controls the positive readout, then a high Reset line locks the circuit for continuous positive readout. Likewise, a high Set pin locks the Q output high for continuous negative readout. Returning the switch to center allows the clock to take over, and the circuit will cycle with the next clock pulse. Thus, There is a simple but effective manual override for the automatic circuit whenever we wish to closely monitor any one of our voltage or current readings.

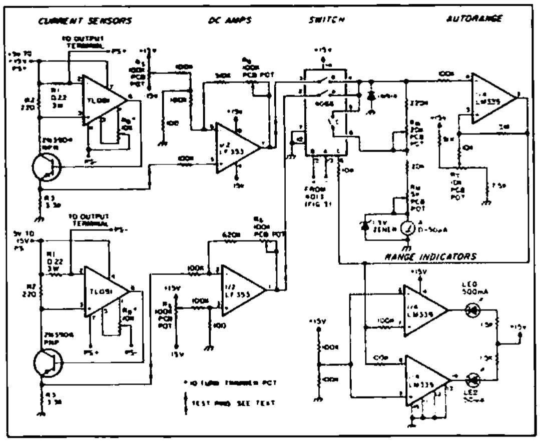


Figure 4. Schematic of the auto-polarity, auto-ranging current monitor.

The voltage sensors consist of unity gain buffers following a simple resistive voltage divider network. Feeding between one-tenth to one-third of the voltage to the buffers ensures that the voltage will never rise to near the op amp supply voltage. Near that point, op amps cease to amplify linearly, and accuracy deteriorates. For this circuit, the network provides 20% of the supply voltage to the buffers. The positive voltage buffer is non-inverting, while the negative buffer inverts. The result is that the rest of the circuit always gets a positive voltage. The circuit is similar to one developed by Pepper (*Radio-Electronics*, March 1983, page 64).

Following the buffers is the 4066 bilateral switch, whose individual switches close when their associated control pins go High according to the output from the flip-flop. The 4066 is an improved version of an earlier switch chip and shows a resistance of only about 80Ω per switch section. This low resistance is insignificant for these circuits. A DC amplifier follows the switch to set the voltage fed to the meter circuit.

For some applications, the builder may wish to use separate DC amplifiers for each buffer and install them ahead of the 4066 switch. A gain of 3.3 provides a maximum of 10V for an analog meter, well within the op amp limits. For use with digital voltmeter circuits, adjust the gain of this amplifier according to need. For example, with an original one-tenth sample at the resistor divider and a unity gain amplifier at this point, the circuit will show .5 to 1.5V for power supply settings of 5 to 15V (either polarity). Digital measurement would thus require only a change in decimal point position.

Since the DC amplifier is non-inverting, the feedback resistor network of Rf and Rg is easily altered. Keeping the 100kΩ trimmer and the 100kΩ input resistor, Rf then equals 100kΩ times the difference of the desired gain and 1, with another 100kΩ subtracted for the trimmer pot. Unlike the unity gain buffers, which require no offset balancing, the DC amplifier shows a remnant offset voltage which detracts from accuracy. The external balance circuit at the inverting input terminal provides easy adjustment for no output when the 100kΩ input resistor to the non-inverting terminal is grounded rather than connected to the 4066.

The analog meter circuit uses a Radio Shack 0-to-15V voltmeter which comes with an external series resistor of about 15kΩ. This circuit replaces the series resistor with another combination to drive the 1 mA meter movement. Since the op amp output voltage corresponds to the sensed voltage, 10V from the DC amplifier equals 15V at the resistor divider terminal. Ten volts at 1 mA requires a 10kΩ series resistor, which is shown as 9.1kΩ plus a 2kΩ trimmer pot for calibration.

Construction is not critical here either, since only DC and slowly timed pulses are involved. Use IC sockets for construction ease. As with the supply board, use pins liberally for off-board connections. The 3 x 3 ½-inch perfboard squares shown in the photos easily hold the circuitry with room to spare. Be sure to place the trimmer pots in easy access areas for calibration after mounting the board in the cabinet. Since lead length makes no difference, mounting all trimmers along the top edge of the board will ease later calibration.

Voltmeter Calibration

Calibration of the voltmeter is a cinch. Balance the DC amplifier by grounding the 100kΩ input resistor at the switch (4066) end and adjusting the trimmer marked Rb until the output is zero. Adjust the input voltage setting trimmers so that the voltage to the buffers is one-fifth (or the desired fraction) of the power supply voltage. Using a convenient voltage, adjust the DC amplifier gain trimmer, Rg, so that the output is 10V (or the desired amount) for 15V from the power supply. Finally, set the meter trimmer, Rm, so that the meter shows 15V for 15V from the power supply. The only other cautions concern the flip-flop. Identify the positive and negative control lines and be sure that the manual override switch and indicator LEDs correspond correctly to these lines. Identify the positive and negative control lines for the current measuring circuit so that the meters will read together.

Current Monitor

Although voltage monitoring circuits are growing more common in bench supplies, there's still little useful current monitoring. A single meter for gross current measurement provides little help for monitoring low current circuits, while a sensitive meter pegs long before the supply nears its maximum rated output. Automatic monitoring of both positive and negative current drain appears only in expensive industrial and lab equipment in the $2,500-and-up class. A simple, reliable, and effective current monitoring circuit, however, has long had a place in the data books.

The current monitor in Auto-VIM owes much to National Semiconductor's Linear Databook circuit for routinely converting current drain to a voltage output without resorting to ultra-precise resistor matching.

The sensor circuits in Figure 4 use different op amps to sense positive and negative current flow. The TL081 (or LF351) Bi-FET op amp uses P-channel inputs which work with input voltages close to the positive supply value, but fail as the input voltage approaches the negative supply voltage. By contrast, the newer TI NFET op amp, the TL091, with its N-channel inputs, shows precisely the opposite characteristics. Between the two, we obtain separate but parallel sensors for positive and negative supply currents.

The transistors, whose base current is controlled by the op amp output, control the voltage seen at the 3.3kΩ resistor. In fact, the circuits provide an output voltage per mA of line current equal to .001 times the product of R1 and R3 divided by R2. The circuit shown provides .0033V per mA, or 1.65V at 500 mA. Sensor circuit output is positive for the TL081/2N3904 combination and negative for the TL091/2N3906 duo. Although most data book circuits show FETs rather than transistors used with the FET input op amps, the bipolar transistors work better at the 5V end of the power supply range. Note the 10-turn trimmer pots marked Rb, which will receive attention during circuit calibration.

A DC amplifier follows each sensor to increase the voltage to a level desired for measurement. As with the voltage monitor, the negative amplifier inverts while the positive does not, thus yielding positive voltages for the bilateral switch. Each amplifier has a gain of 6.7 so that the metering circuit will see 12V at 500 mA, which is within the linear range of the op amps and within the switching range of the 4066. Each section of the LF353 includes an offset balancing circuit to decrease errors introduced by remnant voltage outputs.

(to be continued)

73 Review *by William J. Mick K3RVN*

Number 6 on your Feedback card

Heathkit SB-1000 Linear Amplifier

Shake and bake test results of a low-priced amplifier from Heath

Heath Company
Benton Harbor MI 49022
Price Class: $700

Whew!

Heath had me worried there a while. For years, hams could count on them as a reliable source of HF linear amplifier kits for the amateur market. Then, to widespread dismay, ham amplifiers disappeared from the product line. Many hams would think twice about building a micro-controlled transceiver, but an amplifier is something comprehensible, probably even repairable, the perfect kit-based station addition. Fortunately, Heath came up with something nice to fill the vacuum. The SB-1000 proves that hams still have friends in Benton Harbor.

The SB-1000 is a classic tuned cathode fed, grounded-grid design using a single 3-500Z power triode. The basic circuit has been an ARRL handbook staple for years. Variations on the 3-500Z theme, with one or two "bottles," have been marketed by numerous manufacturers since the mid-seventies. In fact, under the skin, the design of the Heath SB-1000 is based on the popular AL-80A linear built by Ameritron.

The SB-1000 is not a kit for the first-time kit builder. It contains a 3000 VDC supply, and obviously demands a workmanlike approach in assembly and checkout. Don't rush through this kit, or skip steps, unless you like to live dangerously.

Packing

Everything comes in a fifty-pound box internally sectioned with separate boxes and bags of parts to support each phase of construction. The manual and accompanying foldout charts are of the usual high Heathkit standard. There are also a few pages of errata, mainly typographical and pictorial corrections, that must be integrated with the instructions. None of them appear to be concerned with the kind of detail that endangers life or property.

Subassembly

The amplifier is built on a heavy gauge steel chassis, with an internal partition that separates the RF deck from the power supply and control circuitry. In typical Heath fashion, the first few evenings of construction concentrate on various subassemblies. For me, there were about twelve solid hours of piecework before the thing started to look like the picture in the catalog. In a moment of weakness, I fell victim to the old kit-builder's affliction, cantwaititis. There I was, loosely bolting the chassis' panels together for a preview of the final product on the operating bench. This of course aggravated the condition, as the SB-1000 looks pretty good. The compact size, simple control layout and gray-toned color scheme go very nicely with most modern ham equipment.

PS Rectifier Board

The first piece to build is the power suppy rectifier board, which requires about an hour. This board needs double checks of rectifier diode polarity, as each is soldered in place. The rectifier board was not easy to solder, even though it was pre-tinned. The instructions stated about two or three seconds of heat per joint, but it took twice as long as that to yield sound joints. Fortunately, all the diodes survived despite the additional heat.

The power supply filter board takes another hour or so, and took solder much more easily than the rectifier board. It uses ten large electrolytic capacitors in series, so polarity is crucial. The instructions state that the polarity of each can should be rechecked when the board is complete, but I couldn't do it. The little plus signs on the capacitor tops were out of sight under the board, and not even a dental mirror helped. Builders who don't have a proctoscope may want to mark the sides of the cans before bolting them to the board.

Less than two hours were required to build the boards that handle ALC, power measurement, and meter switching. Construction is fairly simple, except for diode polarity and a couple of multi-colored wiring harnesses.

In contrast to the circuit boards, the input filter unit construction demands patience and dexterity. This unit is a small shielded box that surrounds part of the bandswitch, and it contains a number of slug tuned coils and capacitors. These form individual pi-networks for each band, and there is ample opportunity to connect the wrong bandswitch contacts, or to short some of the longer leads. Liberal use of spaghetti tubing and artful dressing of the numerous wire leads will avoid problems. The Heath assembly pictorials are very clear, and therefore invaluable at this stage. The coil forms snap into holes in the sides of the filter box, and carefully controlled leverage is the only way to install the coils without breaking them.

"Special" RG-58/U

At one stage of input filter assembly the instructions call for a length of small coaxial cable. After twenty-five years of hamming I tend to associate the term "small" coax with something like RG-58/U. In due course a piece of cable marked RG-58/U was found among the SB-1000 parts, but the length wasn't right. A piece of subminiature coax was discovered, and its length did correspond to the instructions, so obviously this was intended for the input circuit.

I've used subminiature 50Ω coax with 100 watt transmitters before, so the use of this really small cable wasn't too much of a surprise. However, it was now obvious that the "large" cable used in the amplifier's output circuit was the piece of RG-58/U. This caused me some concern. Consultations with several other long-time hams didn't offer any comfort. The ARRL Handbook tables show 650 watts and 1900 VDC as the upper (albeit conservatively rated) limits for RG-58/U. In fact, the SB-1000 operating instructions actually recommend that RG-58 and RG-59 feedlines be avoided in favor of heavier RG-8 or RG-11 coax.

I made inquiries of both Heath and Ameritron concerning the use of RG-58/U for the amplifier's output circuit, and received quite similar replies. Although the piece of cable in question is simply marked RG-58/U, it is actually a special Teflon™ insulated cable rated at 2500V. This is not garden variety RG-58, and it is certainly easier to handle than RG-8 when wiring up the amplifier. Cables of this type can be found in a number of modern commercial amplifier products. Its heat resistance is a useful property inside power tube enclosures.

The rear part of the bandswitch assembly handles switching of the plate tank circuit, a tapped pi-network design that incorporates a big tapped toroid inductor for 80 and 160 meters. Doorknob padding capacitors are switched into the circuit on the lower bands, which permits the use of reasonably sized variable capacitors. It's a compact and practical design, and looks a great deal like handbook amplifier designs of recent years, except for the bandswitch.

Bandswitch

Almost every homebrew transmitter, amplifier, or high-power ATU I've ever built has involved a careful search for a heavy duty wide-spaced RF switch for the tank circuits. The SB-1000 bandswitch, a CentraLab designer-type unit, is not typical of handbook amplifiers, which usually specify something like the Millen 51000 RF switch, or a heavy-duty surplus monster. Now, it's hard to believe that I, or the ARRL, have been overbuilding

power amps all this time. On the other hand, neither homebrewers nor the ARRL lab are much constrained by the realities of commercial competition.

In response to my queries, Heath stated that the ceramic bandswitch in the SB-1000 is conservatively rated at 9 amps AC and at 2500V. Furthermore, Heath said that the SB-1000 was run through a rigorous series of FCC tests involving all manner of electrical abuse without any switch problems. Ameritron pointed out that similar switches have been used on kilowatt linear amplifiers of various manufacturers, including Drake, Swan, Dentron, and Heath itself, for some years.

Final Assembly

At this point, I attempted to suspend my prejudices and do the appropriate thing: finish assembly of the amplifier and proceed to beat the hell out of it. The rear panel went together in about three hours, complete with heavy duty primary power relay and RF-filtered AC cable. Phono plugs for external RF relay control, 12V accessory support, and ALC output voltage were also wired up. Also on the rear panel is a safety interlock switch that cuts the AC power when the SB-1000 lid is removed.

The center partition panel holds the two big transmitting capacitors and cooling fan, and is an easy job. Likewise, the front subpanel, with meters and accompanying meter lamps, went together smoothly, right down to the Jackson vernier reduction drives used for the tuning caps. The method used to mount the meters is not very rugged, being a couple of solder lugs at diagonal corners, but it does hold once the panels are bolted together.

Integration of the front subpanel and center partition with the chassis base was not easy. A fair amount of warping and twisting is necessary to make screw holes and capacitor shafts line up properly. Various hardware items must be loosened and aligned to permit smooth control rotation and squaring of all the corners. Another hour or two saw the installation of the power supply rectifier and filter assemblies, and connection of the rear panel. Numerous flying leads and wiring harness ends must be interconnected. Except for minor glitches, like a couple of bad screws, and an out-of-reach solder junction, everything went together pretty much according to the detailed instructions. There was one resistor whose leads could not be trimmed to the specified length because they were already too short.

Fitting of the front fascia and the 3-500Z tube were almost anticlimactic, and after about fifteen hours of construction, the SB-1000 was at last ready for testing.

For obvious reasons, one does not plug in and go at this stage. I spent a good forty-five minutes verifying connections and checking for solder bridges and pinched wires. The rear panel barrier strip was wired for 240V AC input, so the 120V plug was removed and a suitable 240V plug was installed. The lid was set in place in order to engage the interlock, and the unit was plugged into the AC mains.

The thing I hate about high voltage equipment is having to get near that front panel the first time the main switch is thrown. I pushed the SB-1000 power switch with a piece of broomstick and a resounding THUNK! shook the house as the transformer field sucked in the sides of the loose lid. The power supply hummed a bit, but there was no sparking, no arcing, no smoke. The front panel voltmeter showed 3300 VDC, and the 3-500Z glowed encouragingly. Home-brew or kit-built, you get a lot of satisfaction when you first put the juice to the product of your labors and nothing bad happens.

Final Pre-op Tuning

A detailed set of alignment procedures takes the constructor through the tuning of the input matching networks. For this step, the lid must be slid back a fraction of an inch from the front panel while a nylon alignment tool is used to peak up the coil slugs. This is definitely a situation where one hand stays in the pocket. It is worth enlisting a second operator to dictate the instructions, key the exciter for you, and act as safety man. Everything went by the book, and after heating up the Heath Cantenna for awhile, the moment of truth had arrived—it was time for the SB-1000 to speak to the world.

SB-1000 On The Air!

It spoke very well for itself, reaping a lot of favorable comments and no criticisms from any of the stations worked. An FT-102 and an IC-751A were initially used to drive the amplifier, and both had more than enough power to yield full output from the SB-1000. In fact, as the amplifier is rated at 85 watts maximum drive, the exciter carrier levels were reduced slightly to avoid overdriving it. The input tuned circuits are fairly broadbanded, but the drive sometimes has to be brought up a bit when the frequency is away near a band edge.

The SB-1000 has adjustable ALC output of up to twenty volts to help regulate the drive for a clean signal, although this required some fiddling to adjust. The first few months of testing took place in a club environment, and the ALC connection seemed to be unplugged as often as it was connected. It is probably just human nature to resist something which seems to be retarding those satisfying meter swings.

During three months of on-the-air use, there was no evidence of breakdown or other inadequacy in the special RG-58/U, the bandswitch, or even in the antenna relay, which is a plastic insulated AC power type. The antennas used were a well-worn tribander beam and a G5RV multiband dipole, without benefit of an ATU.

The testing environment was one of the worst possible: a club hamshack. A number of hams had the chance to stress it and abuse it, and that's just what they did, mostly unintentionally. Appliance operators accustomed to auto-tune rigs have treated the SB-1000 like a broadband device, changing the bandswitch, but neglecting the tuning controls. Some people take a long time to tune up or forget to watch the grid current meter. In spite of the rough treatment, the amp worked well until halfway through the ARRL DX contest.

What actually happened no one seems to know, except that serious internal arcing was heard on 15 and 20 meters. Examination showed that the safety RF choke at the output of the pi-network was open, but it was hard to tell if this component was the cause or a victim. It was clear that some pretty high RF voltages had jumped from a stator contact on the bandswitch to the metal shaft. There was a great deal of carbon build-up on the rotary wafer, but the rotary contacts were clean. The stator contact, which connects the padding circuit for the plate variable capacitor, was eroded completely. Replacement of the small RF choke and removal of the doorknob cap permitted operations to resume on 80 through 10 meters, but the bad wafer will have to be replaced in order to reenable 160 meter capability.

Despite my original misgivings about the switch, I don't feel that it was the source of the problem. It did work for three months, and it took a contest operation with a lot of different operators to bring about the failure. An insulated shaft might have prevented the arc-over, but after seeing the amount of dust and fuzz collected on the air intake vent and on the floor of the RF section, I am inclined to believe that it was dirt that started the arc.

Top Dollar Value

The price of the SB-1000 is very attractive at about $700. Compared to the big "dollar-a-watt" amplifiers on the market, this amplifier is an economical way for a guy who isn't QRO-crazed to boost his signal when he needs to. It is not built to be indestructible, but it isn't priced like a continuous service amp, either. While the amplifier is advertised as covering 160 to 15 meters, any technically competent ham will be able to figure out how to make it work on 10 meters as well. If you know what you're doing, you won't even have to buy any additional parts.

One thing Heath might do is to review the list of required tools, which seems to be the same list whether the kit is a simple noise bridge or a high power antenna tuner. I found several points during construction where a 25 watt soldering pencil was not hot enough for the job. A 100 watt gun was needed for some of the heavy power supply and tank circuit connections, and it was necessary to use a 250 watt gun when soldering the safety RF choke in the output circuit to the bandswitch frame.

Conclusion

Heath, traditionally the friend of the ham on a budget, has once again provided a cost-effective piece of gear that will do both the manufacturer and the constructor credit. Thanks are due to Denton Bramwell at Heath and Tom Rauch at Ameritron for their courteous and helpful responses to my questions. Although I personally would have selected heavier components for the bandswitch and antenna relay, I am satisfied that the supplied parts are adequate for the job. The club members are enthusiastic about the SB-1000, and while we have asked more of the amp than we should have, we look forward to a lot more heavy use in the future. ■

HANDHELD TRANSFORMATION

Update your Kenwood Mini HT

by Rich Greenberg N6LRT

The Kenwood TH-XAT (21, 31, 41) series handheld transceivers are fine rigs. Being the smaller units, they fit inconspicuously into places other HTs just won't go. Unfortunately, with the Kenwood CTCSS (Continuous Tone-Coded Squelch System) unit inside, changing CTCSS frequency is inconvenient at best. The newer Kenwood TH-X1BT rigs solve that problem by adding front panel dip switches to set the CTCSS frequency. With a few parts from Kenwood, anyone can easily upgrade his or her HT and have the added convenience of selecting the CTCSS frequency from the front panel.

Carefully follow these instructions to install the modification.

First open the radio's case by removing two screws from the bottom and one from the side near the top, opposite the PTT button. Loosen, but do not remove the screw just above the PTT button (Figure 1). Pry the front panel off the chassis. See the TU-6 instructions for this disassembly.

Next modify the TU-6 by clipping the PC board opposite the programming pins 1-6. Remove the narrow piece of PC board so that the pins are clear. Do not disturb the seventh pin, which is grounded to the board. See the sketch on the TU-6 instruction sheet. Install the TU-6 unit at this time if the HT does not yet have this option. Do not solder the programming pins yet.

Carefully pry the speaker and microphone out of the old front panel. Straighten out the tabs holding the speaker grill onto the old front panel, remove the grill and mount it onto the new front panel.

Using a fine-tip iron, unsolder the four wires running to the PC board mounted in the old front panel. Remove excess solder from these wires. *Do not* overheat and melt the insulation on these wires. Set the old front panel aside.

Now tin the six programming pins on the TU-6 and the seven pads on the PC board in the new front panel. **Caution:** Don't overheat the chip.

On the flex PC board (or substitute), tin the seven copper leads at each end. Note that one end matches the spacing on the PC board in the new front panel. The other end matches the spacing on the TU-6 programming pins. On the TU-6 end, bend the copper tabs at a right angle where the tabs leave the plastic. Solder the flex PC board to the TU-6 programming pins on one end, with the seven pads on the PC board in the new front panel on the other end. The seventh tab at the TU-6 end is soldered to the grounded pin on the TU-6. This flex PC board will be routed in a zig-zag and folded to close up the front panel. If the user has access to a factory TH-X1BT (I didn't), copy the way its flex PC board is routed.

One at a time, unsolder and discard the four short wires from the PC board in the new front panel. Then connect the four wires (follow the colors) that were disconnected from the old front panel to the new front panel.

Mount the speaker and microphone in the new front panel. Then secure them with a few drops of glue. **Caution:** Don't get glue on the speaker cone.

Now reassemble everything in reverse order of disassembly. The output levels most likely have to be reset for the TT pad and the CTCSS. Put the gummed label showing the CTCSS frequencies inside the battery compartment The bottom edge should be flush with the bottom edge of the battery compartment.

With a needle or fine bladed knife, gently remove the TH emblem from the lower front of the old panel. Then glue them onto the new front panel. (The old glue may still hold.) Transfer the lanyard to the new front panel. And that is it. ■

1. Top case assembly with DTMF pad. Part number A02-0745-05. This includes the six position dip switch. Price, $21.80.
2. Flexible PC board, part number J25-3469-05. This part is optional but suggested. A short piece of seven conductor ribbon cable or individual wires can be used instead, but this part will make the wiring simpler. Price, $17.90.
3. Label, part number B42-2450-14. This is a gummed label that shows the switch positions needed for the various CTCSS frequencies. Price, 55¢.
4. The TU-6 standard CTCSS encoder board for these radios, if the user doesn't have it already. The price is $36.95 from the local dealer, ***not from the Kenwood parts department.***

When ordering parts directly from Kenwood, the operators will charge the order on MasterCard or Visa. The phone number to call for parts is 213-639-9000, ext. 421, 422, or 429. Prices shown were verified in late March 1988, and do not include shipping or sales tax.

Table 1. Parts required to upgrade any TH-21/31/41AT handheld transceiver to a BT model.

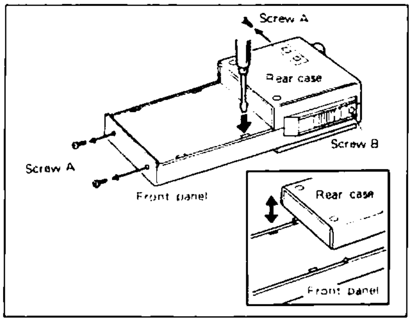


Figure 1. Disassemble the case by carefully removing three screws (A) and loosening screw B.

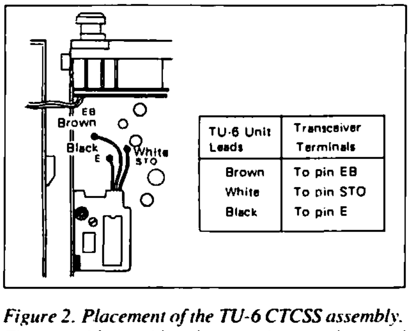


Figure 2. Placement of the TU-6 CTCSS assembly. The assembly is soldered in two places and secured with one screw.

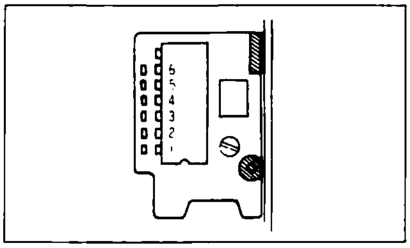


Figure 3. TU-6 CTCSS IC pin designations. Note pin 1 is nearest the notch in the IC.

The Quest For Ultra Portability

Part 7 in the High-Tech Nomad series

by Steven K. Roberts N4RVE

When I first set out on my strange 8-foot-long, 140-pound bicycle back in 1983, I received a lot of serious advice from my Ohio neighbors. "Never turn onto a road with 'mount' or 'hill' in its name," said one seasoned cyclist. "Never let anybody nicknamed 'Moose' ride your bike." "Carry a weapon, but make it a light one." "Don't mess with camp cooking gear." "Drill out your toothbrush." "Get a lighter tent." "Make everything you carry do double duty."

I noted that most of the advice had something to do with weight, which is not unreasonable given the fact that a good percentage of the bicycle-touring lifestyle involves hauling possessions up steep hills. The Winnebiko system has since grown to over 275 pounds, and believe me... I feel them all.

But it's worth it. With every QSO, every piece of packet mail, every chapter completed via the handlebar keyboard and on-board computers, I become more and more delighted with my solar-powered mobile-radiotelecommunications system. I have broken the chains that once bound me to my desk, beat the freedom-versus-security trade-off, and moved into a life of adventure in Dataspace—a constant flirtation with that sweet piece of asphalt I have come to call the Other Woman. This rhapsody is all quite lovely, but I have one BIG problem.

Got a Gizmo?

I'm addicted to gizmology. I love the gleam of blinking control panels, the birth of complex systems, the precise crackle of distant voices amplified through the tight spectral aperture of a fine radio.

I get goose bumps at hamfests and trade shows. I view every new toy in the context of its bikeability, and I'm now getting dangerously carried away with dreams and development of the Winnebiko III: OSCAR Mode L, Packsat, 10 FM, ATV, LORAN-linked CD-ROM mapping on 640 x 400 graphics, improved HF, Oki cellular phone, FAX, 40 watts of solar power, 54-speed computerized automatic transmission, trackball interface, packet/laptop remote control, hydraulic brakes, integrated bike/tent system... I want it all. Yes, it's a big problem.

"Some problem!" you say. "There ain't an OM alive who wouldn't deed over his solid-gold Vibroplex for a toy collection like that."

Well, that may be, but the catch is that I still gotta *pedal* it.

Mindful Minimization

Given that constraint, I have a very strong motivation to maximize efficiency. How light can I make it? Can an amplifier (or a computer, or a battery, or even a piece of coax) do double or triple duty? Can interconnections be software-managed to minimize the number of heavy, inflexible switches and wires? Can I eliminate cases and replace only the metal necessary to provide adequate shielding? Are there "sleep" modes available that let me maximize battery life? Can I reduce battery weight by increasing antenna weight—or would the opposite make more sense?

With the understanding that more and more hams are interested in portability (now that equipment size is finally making it worthwhile), I'd like to maunder on for a bit about some of the ideas that have emerged from the 5-year Winnebiko project...

Weight

Let's take the obvious points first. Keep it light. It took me years to learn that putting a lot of light things together gets heavy—and shaving away lots of ounces adds up to pounds. Amazing.

As the most-significant digit of the Winnebiko's revision number increments for the third time (yes, there was a 0.1), I am drilling holes and machining away excess aluminum, G-10, and plastic. Mounting plates can be perforated, angle brackets shaped, circuit boards trimmed, cases eliminated, tools drilled. New logic, wherever possible, is surface-mount. The steel base of my Bencher/Pacesetter keyer is history. And I'm taking a hard look at former indispensables like juggling balls, frisbees, kites, water filters, DB-25 spares, flares, and the like—weighing their value beside such things as LORAN-C boards and mast-mount preamplifiers.

Closely allied with this issue is the ongoing quest for lighter, smaller versions of existing tools. Two manufacturers that I know of (Leader and Dolch) now have combination LCD oscilloscopes and DMMs—a bit heavier than my existing DMM but well worth it for the added functionality. The MFJ-313 VHF downconverter plugs into a 2-meter handheld to replace the Radio Shack weather radio while saving 80 grams (and many new HTs like the Yaesu FT-23R can be tricked with a jumper change into tuning 162.55...). Even the obvious—like buying an Xcelite screwdriver set to replace a bunch of Stanleys—can knock nearly a pound off the mobile tool kit.

Multi-Functionality

This can be a tricky one. There's a big trade-off here: The more functions you perform with each piece of equipment, the fewer you can perform simultaneously. Let's look at cables, for example, since wire is heavy.

On the bike, I have a standard "power extension" cable with an RCA on one end and a coaxial power plug on the other. The RCA fits any of eight jacks on the console (system voltages, solar charge current, etc.) and the coaxial fits entertainment electronics, tent lights, and a jack on Maggie's bike. But the same cable, used in reverse, also allows her UNGO security sensor to be slaved to my bike's system.

Obviously, I can't do this while watching TV on the Watchman under bike power, but then... why would I want to? The trick therefore is to make multifunctional cables for functions that don't normally go on at the same time.

Another example: Maggie's bike carries a 5-watt Solarex photovoltaic module, and mine has a pair of 10-watt units. Due to the need for wire antennas on QRP, I only operate HF when we're stopped for a day or more. I have found to my surprise that quality IC sockets hold chips better than I expected. For a few thousand miles, I kept a camping pillow bungeed over the main logic board, but it turned out to be unnecessary. Anything delicate with significant mass, of course, needs special treatment... I mounted the Yaesu 290 on a foam pad, held down with springs that pull it slightly forward into an undersized console cutout lined with channel-rubber. The H-P computer lives in a foam-lined case

resting atop clothes and tent fabric. And the new radio pack with the OSCAR and HF hardware will be a case within a case, nestled snugly in soft foam. Don't be tempted to spring-mount a system if overall balance is critical—the whole mess will exhibit resonant modes that require heavy damping hardware.

Moisture can be a serious problem outdoors, of course, and not just from rain. As I mentioned in an earlier article of this series, the console electronics on the Winnebiko are well protected by the fairing, fabric side-panels, and velcro-on cover. But condensation can be a real problem, and fighting it calls for either a true hermetic seal or free ventilation—the former to maintain a truly dry environment and the latter to quickly undo the damage if you don't have the former. I have found better results from leaving the whole system outside on a cold night instead of bringing it into a tent filled with the moisture of human bodies, and a simple tarp in combination with the waterproof fabric cover keeps the worst of the condensation at bay.

And then there's heat. Normal electronics can withstand the temperature range of this planet, but parking anything in New Mexico sunshine invokes a phenomenon known as solar heat gain, which takes effect when air spaces exist under transparent covers. Examples of this situation are: LCD, panel meter, and lexan fairing. Solar heat gain can be tragic—it blew my computer's mind in Mendocino. I have found two solutions: a space blanket, shiny side out, will keep any piece of equipment comfortably at ambient all day long; failing that, a DC fan running from the solar panel moves enough air to keep the temperature under control. Mine is a little EG & G unit from a hamfest, drawing 270 mils from the 12-volt supply. On hot sunny days, that's about 40% of the output of one of my 10-watt photovoltaics. (The space blanket works much better, of course, but it's messy and has to be tied down in the wind.)

No discussion of environmental abuse is complete without at least a passing acknowledgment of dirt: crud, grime, mud, dust, sand, grit, goo, cigarette smoke, sludge, salty spindrift from oceans, corrosive airborne industrial contaminants, cat hair, and worse. Again, modern electronic hardware can put up with incredible abuse, but pay special attention to coax, stripline, moving parts, magnetic media, and high-impedance analog circuitry. Human sweat, dripping on a circuit board in a humid environment, can dissolve uncoated traces.

Salty residue on antennas can soak up RF like a dummy load. And don't forget the effects of dirt on cooling: If for some strange reason a piece of equipment requires an internal cooling fan, keep a close eye on filters (a mixed blessing if ever there was one).

Prototyping Techniques

All of the factors mentioned so far impact the choice of construction technique, right down to IC packaging. Keep connectors to a minimum. . .but use them wherever necessary to simplify service (another trade-off). Use R-N quick-connect instead of wirewrap for logic prototypes—or printed circuit boards if possible. I'm discovering in the design of Winnebiko III that it can actually be cheaper to prototype at the PCB level. Depending on complexity and quality, custom boards can be delivered within 2-3 days from CAD artwork for $50-250. And—delight of delights—it's turning out that there is no real premium (other than assembly effort) for making surface-mount instead of DIP boards. SMDs are the devices that have made the new class of personal electronics, including micro-sided HTs, possible.

I'm doing PC boards for the easy stuff that requires little debugging (memories, crosspoint matrices, and the like), and sticking with Quick-connect insulation-displacement prototyping boards for the logic that changes shape everytime I see some new chip that looks interesting. . .

Software-Hardware Trade-offs

. . .which is a good point to start talking about software. In the past, we as a class (tinkerers, experimenters, engineers, and techs) tended to do most of the fiddling in hardware. Proto-boards, #22 and #30 wire, wirewrap tools, soldering irons, and junkboxes were always close at hand. The problem is that all this stuff is heavy—and not the best way to protect the investment in technology.

The biggest flaw in the Winnebiko II design is that, despite the five microprocessors, there is little architectural flexibility.

Front-panel switches are necessary to change modes, bring up supplies, override the serial communication matrix, control battery charging, and so on. This is heavy, and lends itself poorly to further development (largely because any significant design change implies considerable down time).

The new bike will be considerably different. A 16 x 16 analog switch matrix under computer control allows any combination of audio sources and sinks to be connected together—with spare points handling inter-processor communication outside the domain of the high-speed LAN. A window on the graphic display can be used to edit special interconnects, but normally the processor will simply toggle the 256 crosspoints as dictated by the tasks in progress (ranging from a cellular phone call through the bike helmet to OSCAR operation with two transceivers and a patch to the tape recorder). Touch-tones, mike audio, mixer inputs to the console speaker—all are processed through this board, and NONE of them require a drop of solder or a twist of the present clunky rotary switch that's a pain to use and even harder to "edit."

Other functions appear in software as well: battery charge management, temperature control, the transmission-control shell, navigation, and just about everything other than basic survival hardware (lights and horn). Knowing that I'll never get some of these things right the first time, the use of software control makes good strategic sense from an engineering standpoint (butane soldering irons notwithstanding).

And best of all, it cuts weight while adding capability. Another trade-off bites the dust—which is what it's all about! ■

Readers who would like to order a reprint of Steve Robert's series (seven articles to date) should send $3 for the first and $1.50 for each additional article, to 73 Magazine, WGE Center, 70 Rt 202 N, Peterborough, NH 03458-1194. Attn: Reprints.

Readers can also order Steve Robert's book at Computing Across America, 1306 Ridgeway Ave, New Albany, IN 47150. They can buy a signed copy of Computing Across America, the 350-page book that talks about the first 10,000 miles of Steve Robert's biking odyssey, for $9.95 (softcover), or $15.95 (hardcover). Add $2 per book for postage and handling.

Number 9 on your Feedback card

DIGICOM>64

A software-based packet radio system for the Commodore 64

by Barry N. Kutner, MD W2UP

Cheap n' Easy Packet!

Packet radio is a relatively new and exciting mode of communications. Unfortunately, there's still often considerable expense to get on packet. A personal computer (or ASCII terminal) and a terminal node controller (TNC) are required for packet operation. Fortunately, the former is already in many ham shacks today. The TNC consists of two main parts: the packet software (in ROM), and a modem circuit for tone encoding and decoding. Together, they produce and decode the packet signal.

I'd often wondered why no one has written a program to emulate the functions of a TNC that would eliminate the need for a somewhat expensive and mode-specific piece of equipment. Well, it *has* been done! Several German hams wrote the system I describe below for the Commodore 64 (or C128 in the 64 mode). It is public domain! While popular in Europe for several years, it remains relatively unknown in the United States. I and others have been providing copies of this software for the ham community.[1]

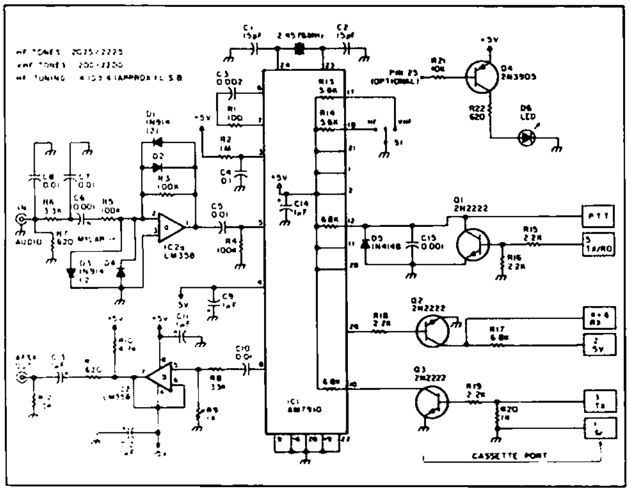


Figure 1. Modem for VHF and HF use, designed by Willy Pedersen YV1AQE. Tone frequencies are 2025/2225 Hz for HF and 1200/2200 Hz for VHF. Switch is SPDT with center off. Center position is for VHF operation with Equalizer on (for receivers with rapid high frequency roll off). Optional lock detect LED is shown. If not used, leave pin 25 open. Pins 13, 14, 15, and 27 are not connected. The AM7911 may be used in place of the 7910. If used, change R1 to 910Ω.

Why take this approach to packet radio? Personally, I don't like being an "appliance operator." I like to build, modify, and troubleshoot my own equipment. The miniaturization of solid state gear, however, has made this difficult for the non-engineer. I am an eye surgeon who operates through a microscope, and the compactness and complexity of my own equipment intimidates me! Further, with the number of Commodore 64s out there, this system provides inexpensive and easy access to packet radio for many.

In this article, I briefly describe the Digicom>64 software and a relatively simple and inexpensive interface. Complete software documentation is a available with the program.[2]

Program Basics

The current release of Digicom>64 is version 2.00. It has all the capabilities of the common commercial packet systems, plus some. It has multi-connect capability as well as direct read and write of both PRG and SEQ files to disk (full 8 bit transfers). *True store and forward digipeating (similar to Net/Rom and KA-node) is available.* Remote command capabilities allow for operation as a mini-BBS, including different security levels of each command for specific stations. Disk logging functions allow one to see which stations have logged on and which commands have been used. Standard buffer texts may be stored for instant retrieval. Up to 10 different parameter files may be stored on disk for HF, VHF, BBS operation, etc. Both 40 and 80 character modes are available. The list goes on....

The program is written entirely in machine language and is about 30K long. Unfortunately, the authors will not release the documented source code (I have asked), so there is no program listing available. Since the program is machine language and data is transferred through the cassette port of the C-64 or C-128, it is machine-specific and will not function with other computers, including the VICs and the SX64.

The Interface

Since the computer takes care of all our packet housekeeping functions, the interface between the computer and the radio needs only act as a modem. It must take the voltage levels from the computer and turn them into audio tones for transmission, and must turn the incoming AFSK into voltage levels the computer can interpret. There must also be control of receive-transmit switching.

The interface circuit (Figure 1) uses the AM7910 chip, a complete asynchronous FSK modem in a 28-pin DIP package. Signal modulation, demodulation, and filtering functions are performed by digital signal processing (DSP) techniques. Analog-to-digital and digital-to-analog converters are included on the chip. It is used in several of the higher

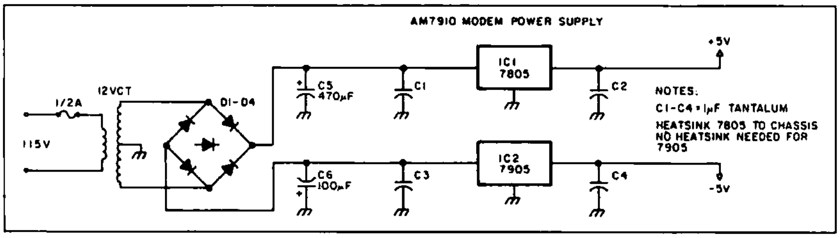


Figure 2. Sample power supply for the AM7910 modem. Heatsinking 7805 to chassis is sufficient. No heatsink is needed for 7905.

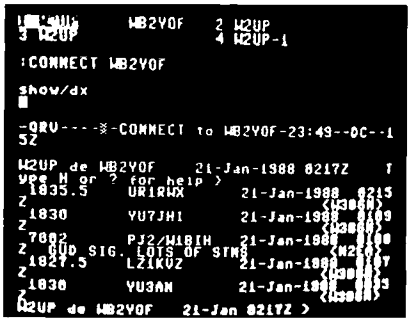


Photo A. The main screen illustrates a connection between port 1 and the Frankford Radio Club's DX spotting Packet Bulletin Board. Split screen operation allows viewing of both transmitted and received data simultaneously.}

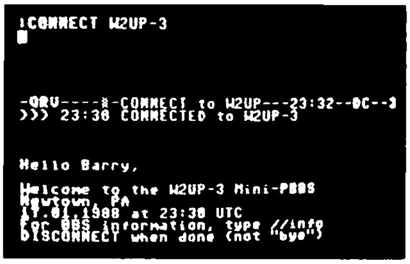


Photo B. Digicom >64 can perform unattended BBS operation. The bulletin board can be used for file transfers or as a personal mail drop.

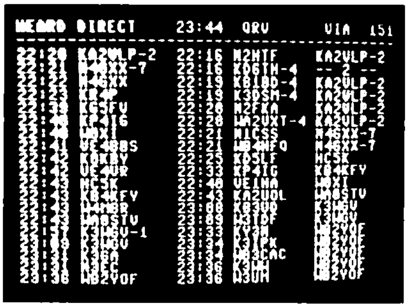


Photo C. The MHEARD screen (displayed by hitting the F7 key) shows recent packet activity. This screen is from actual operation on 20 and 2 meters. Other stations can retrieve this information to see what signals have been heard recently.

priced commercial TNCs. This circuit permits both VHF and HF operation, and no alignment is required (other than setting the audio output level).

Circuit Description

The mode control pins are 17-21. S1 is used to select one of three modes: HF, VHF, or VHF with Equalizer. All three operate in "loopback" mode so that receive and transmit frequencies are the same (half-duplex operation).

The HF mode makes use of the Bell 103 Answer protocol. Tones are 2025 and 2225 Hz keyed at 300 baud. This mode has been chosen to make the switch as simple as possible (SPDT center-off). Many commercial modems use the CCITT V.21 Answer mode, which has different tone frequencies (more on the significance of this later).

VHF mode uses the Bell 202 protocol with 1200 baud operation and tones of 1200 and 2200 Hz. The Equalizer mode accentuates the 2200 Hz tone for use with those transceivers with a rapid roll-off of the higher frequencies.

The analog audio output from the receiver passes through an op amp, used for buffering, into pin 5 of the 7910 and is then processed by the modem chip. The TTL level output appears at pin 26. It is buffered by a switching transistor before going into the computer for "decoding." Similarly, the transmit data from the computer is presented to pin 10 after passing through a buffer transistor. After being processed by the 7910, its analog tones (at pin 8) pass through an op amp before going into the audio input of the transmitter.

Transmit/receive switching is software controlled and occurs at pin 5 of the C64 cassette port. As this output is 6-7 volts, it is divided in half by a resistor network before being presented to the chip. When the PTT goes low, pin 12 goes low. This instructs the modem to enter transmit mode. A high level on pin 12 turns off transmission of data.

The power requirements are +5 volts at 150 mA and −5 volts at 15 mA. A sample power supply circuit is provided (Figure 2).

A few other comments are in order concerning the AM7910 modem. The circuit does not have a tuning indicator. No tuning is needed for VHF. Just set your transceiver to a

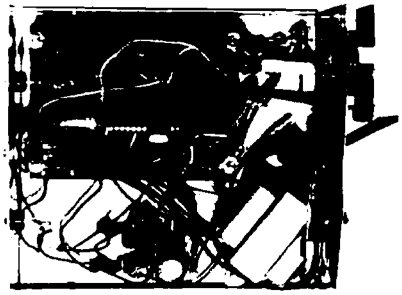


Photo D. This modem was breadboarded. The optional reed relay is shown in front of the 28-pin AM7910.

packet frequency (e.g., 145.01 MHz) and it's all set. For HF operation, tuning is critical and must be within 50 Hz for proper operation. Since the tones generated and decoded are 375 Hz higher in frequency than some commercial TNCs (using the CCITT V.21 protocol), on 20 meters, for example, tune to about 14103.4 kHz, 14105.4 kHz (lower sideband), and so on.

Watchdog Timer

I included plans for a "watchdog timer" circuit (Figure 3). It is based on the 555 timer chip, and goes in series with the PTT line. This circuit provides a timeout of the PTT line after about nine seconds key down. This time constant may be altered by changing the values of R6 or C3 in the 555 circuit. It's not

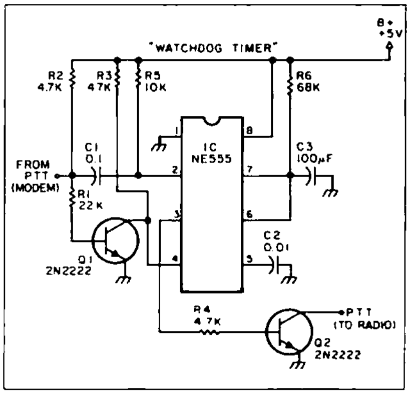


Figure 3. PTT timer for unattended operation. The input is taken from the collector of the 2N2222 at the PTT output of the circuit (AM7910, pin 12 PTT output). PTT to transmitter is taken from Q2. Reed relay may be used.

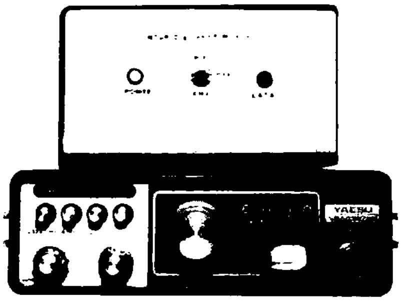


Photo E. The HF/VHF modem with a self-contained power supply. A DPDT switch was used with the center position for power off. The VHF with Equalizer mode was not used.

necessary to always be present during packet operation. Should the computer crash, or if a power failure occurs during unattended operation, it's possible for the transmitter to remain in the key-down state. This is unhealthy for the transmitter and causes unnecessary interference. This simple safeguard prevents any problems.

Auxiliary PTT Output

The 2N2222 should be adequate to key most transmitters. An optional accessory PTT output (Figure 4) has been provided for those who prefer or need to key their transmitter with a reed relay (e.g., Kenwood TS-430S).

Construction Tips

One thing that often puts a damper on home construction projects is trying to find the parts. Not so here—all parts are available from Jameco Electronics[3] and Radio Shack. I bought the reed relay and 2" x 4" x 6" chassis box from Radio Shack, and all other parts

Continued on page 75

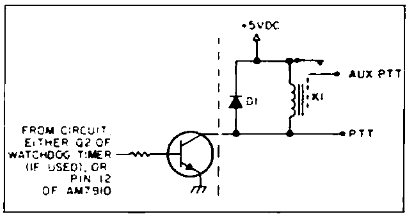


Figure 4. Optional reed relay output for PTT line. Use Radio Shack 275-232 (5 VDC relay).

SMART " S " METER

A circuit designed for T-Hunters.

by Kuby Kubichek N6JSX

This design is for an external signal strength meter that is analog, digital, and audible for mobile "T-hunters." The S meter can easily be made into a small box and placed on top of the T-hunters automobile dash. The S meter also incorporates my secret weapon: a gain circuit. This circuit is nothing special, except that it is able to obtain optimal metering for a good beam bearing. An optional addition to this design is a dampening action. The S meter signal dip that over deviates, is averaged out by modulated transmitter signals or a common occurrence with this dampening action.

The analog meter is a 0–1 mA milliammeter, which is ideal for observing or comparing peak signals when beaming a transmitted one. The analog calibration pot is used to calibrate the external meter with the radios internal meter and control the amount of meter action.

The digital LED bar graph display has a very fast response time and is ideal for nighttime T Hunting. The digital calibration pot works the same as the analog calibration pot. The 3.3KΩ resistor near LM 3914 can be replaced with a 5K pot to control LED brightness.

Safety First

The audible S meter was added for T Hunter safety. The audible allows a T Hunter to swing the beam while traveling in heavy traffic, not requiring his attention to be distracted from the road. This is especially useful when in pursuit of a jammer or on a first-in-first-win T Hunt when speed is critical. The tone pitch will go higher as the signal gets stronger. The tone adjust pot is used to center the audio for optimum listening. The audible meter is not connected to the gain circuit; as the only time the audible meter would be used is when the hunter is close to the hidden transmitter where gain isn't needed.

Key to Success

The gain part of this design is what allowed me, in part, to be a rather successful T Hunter in the L.A. area. When a signal is so weak it is barely audible, this gain feature has allowed me to get a good beam bearing; while all the other hunters switch in their preamps and saturate the radio front ends with off frequency noise. The S2A position gives a 2:1 gain and the S2B position gives about a 50:1 gain. The calibration pots control the amount of meter action relative to the gain. When the signal is heard but not registering on the radio S meter, turn back the calibration pot to zero and the meter will now show the 2:1 gain. If the meter is not showing a significant signal, switch to the 50:1 gain. The hunter needs to recalibrate for an optimal meter indication.

The optional dampening circuit is used for the averaging of a transmitted signal that has modulated power or when a dip on the voice peaks occur. The capacitors may be switched one by one or switched into a very slow response using 5.8 uF total capacitance.

To minimize the loss of eye contact with the road, I used velcro strips to attach the box to my automobile dash. Three conductor shielded mike wires were used between the radio and the external S meter. A subminiature stereo plug was used for the interface. The tip of the plug for the S meter has the power of +12VDC from the radio. The midsection of the plug is for the signal and the shield is used for the ground. This makes a very neat looking arrangement to the radio. All parts where obtained from Radio Shack. Many alterations and customizing can be done to further enhance this basic circuit for your needs. ■ (Credits to: K6KYW and KF6GQ)

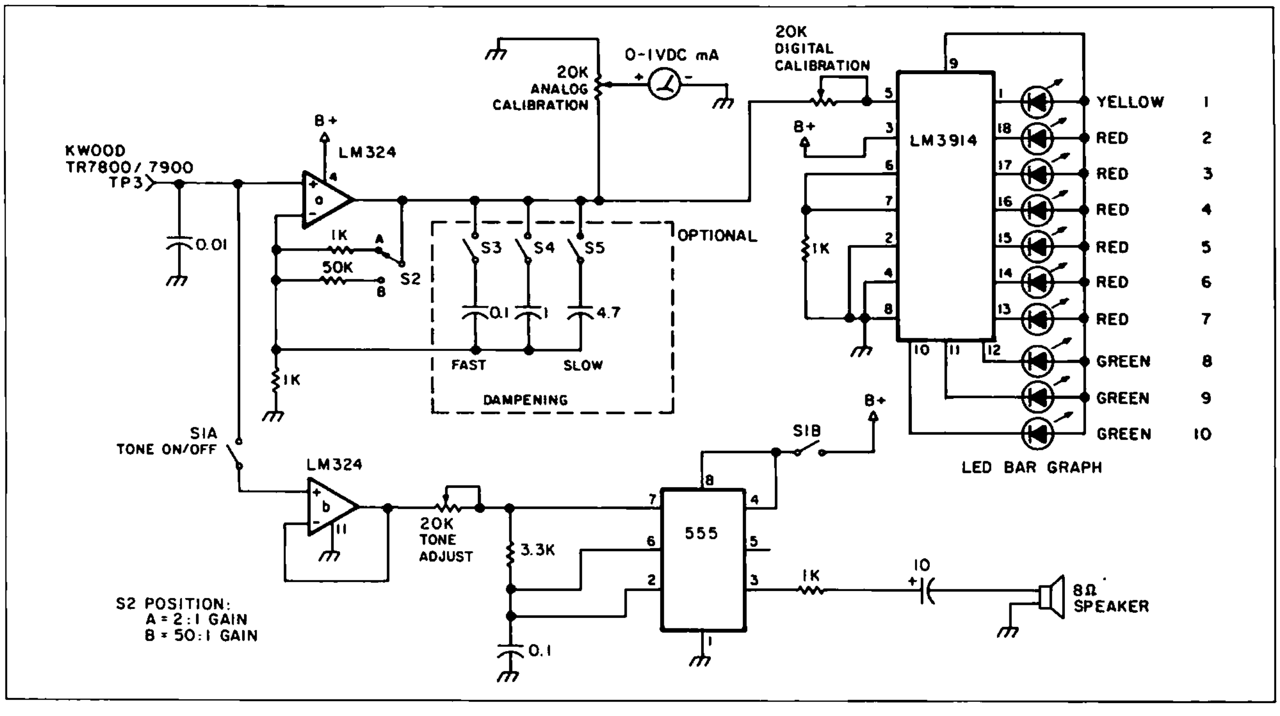


Figure 1. Circuit board for the smart S meter including the analog, digital, and audible for hidden transmitter hunters.

IBM PC Clones

An introduction to the less expensive brothers of the IBM PC/XT.

by Steven K. Stroh N8GNJ

The terms "compatible" and "clone" refer to computers functionally identical to IBM's PC and PC/XT—such computers can use the same hardware and software as the PC. This article hopes to explain a little bit about the extremely popular IBM Personal Computer compatibles, used more and more in amateur radio. It discusses some things the prospective buyer should look for, and look out for. This article doesn't pretend to give enough information for the buyer to rush right out and buy one, but it's a start for more in-depth research.

Why Not a Commodore 64?

It's true the Commodore 64 is so far the most popular computer in use in amateur radio. There's more amateur radio software written for it than any other computer.

The C-64, however, was designed as a home rather than a business computer. It's priced reasonably but there are some drawbacks. The disk drive is slow, and doesn't hold much data. The screen is hard to read. The power supply is unreliable. Furthermore, it's tough to expand with external hardware.

In contrast, the PC is designed as a business computer. Although the early PCs suffered from many of the problem the C-64 did, it was designed on a highly expandable foundation. The PC has survived basically unchanged for more than 5 years—many times a microcomputer's normal lifetime.

The PC was designed with expansion in mind. There are expansion "slots" or connectors built into the computer, capable of connecting many different kinds of equipment, such as high capacity fixed (hard) disks, many different kinds of video displays, extra memory, modem cards, and networking cards. The PC's solid metal case gives the PC much better RFI immunity than a C-64 with its power supply and disk drive cables exposed to the high RF environment found in a typical shack. The PC uses a more powerful microprocessor than the one used in the C-64. The PC's 8088 microprocessor can access a total of 1MB (1 Megabyte) of memory, of which 640KB (640 kilobytes) the PC can use. That much memory lets the PC run much more sophisticated software than the C-64.

IBM puts a high price on all of this sophistication. Fortunately, clones are often much less expensive and fuller-featured alternatives.

The Clones

Get over the aversion of buying a computer without the initials IBM on the front panel. The clones are often as well engineered and reliable as the IBM PC. Clone manufacturers often buy components, such as microprocessors and floppy disk drives, from the same sources IBM uses. The one major advantage to owning an IBM PC is that it's possible to get it serviced anywhere. A clone buyer has to be careful to choose a clone for which he can get good service.

Most Clones Now Fully Compatible

Shortly after the IBM PC first came out in 1981, many manufacturers came out with clones that were almost compatible with the IBM PC. Early clones had incompatibility problems with certain hardware and software that ran fine on the IBM PC. These problems dwindled as the IBM PC's architecture became more thoroughly understood. Software and hardware manufacturers make more effort to ensure their products will work on the more popular clones as well as the IBM PC, because the clones now have a big market share.

Make Sure It's FCC Certified

One of the latest problems to emerge for clones is the issue of FCC certification. The FCC has been cracking down hard on computer manufacturers whose computers exceed the FCC's RF noise specifications, and have shut down some manufacturers until they are in compliance. The owner of an uncertified clone is liable for the RFI it causes! Hams should be especially interested in this, since RFI is a major hamshack issue.

The More the Merrier

Many of the clones now come with 640K of RAM. If possible, get at least 640K of RAM when buying the computer. Many of the larger programs, such as dBase II and Lotus 1-2-3, work much better when more memory is available. "Memory resident" utility programs—those which stay permanently in a sectored-off section of RAM (while the computer is powered up)—are extremely useful because they require almost no access time and save wear on the disk drives. Having 640K of RAM is well worth the modest cost.

Dual Clock Speeds

Dual clock speeds are a handy feature of most of the clones. The clock is the master timing system in the computer regulating the speed at which all operations are performed. IBM never made a PC using the 8088 microprocessor with a clock speed greater than 4.77 MHz. The clones, on the other hand, take advantage of the ability of the Intel 8088-2 (faster version of the 8088) microprocessor to run at 8 MHz, and process data faster. Programs running at 8 MHz scream along compared to running at 4.77 MHz. Although most software and hardware has no problem running at the increased speed, some do, so the clone computers offer the 4.77 MHz speed to accommodate those few fussy programs.

Dual Floppy Disk Drives

So far the most common data storage device is the 5 ¼" floppy disk, which can store up to 360K of data. Most of the clones come with a single 5 ¼" floppy disk drive. Even in a system with a hard disk drive, dual 5 ¼" floppy disk drives really come in handy. Backing up 5 ¼" floppy disks is a real chore without two drives, yet the user will see the need of this the first time he accidentally erases the disk that contained the program he's worked on for 3 weeks. Buy a name brand floppy disk drive, such as Teac or Panasonic. Half-height drives are a better choice than full-height drives for the simple reason that the user can have two half height drives in the same amount of space as one full height drive.

3 ½" Disk Drives

With the introduction of IBM Convertible Computer (IBM's "laptop"), the 3 ½" disk is now standardized in the PC world. A 3 ½" disk is much more reliable than a 5 ¼" floppy disk, and holds up to 800K of data—at least twice that of a floppy.

I deliberately didn't say "3 ½" floppy disks." These disks aren't all that floppy—The actual disk is well protected inside a hard plastic shell, with a cover that is spring loaded to cover the medium access slot, and normally is opened only when the disk is inserted into the drive. The 3 ½" disk is here to stay, and will become increasingly popular in the coming months. Many users now equip their clones with both 3 ½" and 5 ¼" disk drives—the 3 ½" drive allows them to use the much more reliable 3 ½" disks, and the 5 ¼" drive allows them to continue using their old software and exchange disks with other users.

Hard Disks

I won't go into why hard disk drives are such fantastic devices for PCs—rest assured it is one of the main reasons for buying a PC or clone. Keep in mind for now that they move data in and out of the computer much more rapidly than, and store many times the data of, floppies.

Software that's irritatingly sluggish to read from a floppy disk loads in a fraction of a second from a hard disk. Also, the operator will eventually tire of switching floppy disks every time he wants to load up a different program. One hard disk drive that is well thought of in the PC industry is the Seagate ST-225 which has a storage capacity of *20 Megabytes*. It's very reliable and reasonably priced. The user needs also buy a hard drive controller card to plug into one of the expansion slots—I suggest the Western Digital hard disk controller. The 20M hard drive and controller card runs 200-300 dollars.

A Legal BIOS

The IBM PC BIOS ROM (Basic Input Output System Read Only Memory, or bootstrap ROM) is at the heart of the compatibility issue. The BIOS is the lowest level of software in a PC or clone—it's the "glue" that interfaces the the computer's hardware and DOS (Disk Operating System).

Avoid buying a clone from a company who installs BIOS ROM that are direct copies of the IBM PC BIOS ROM. This is a copyright infringement. Once discovered, the company either has to change the chip immediately or suffer a lawsuit from IBM. Rather, look for a clone that has, or will accept either Phoenix or Award ROM BIOS chips. They are the best combination of PC ROM BIOS compatibility without copyright infringement, and price.

8087 Math Coprocessor Socket

Most clones, and the PC, have an empty socket beside the microprocessor reserved for the Intel 8087 math coprocessor. The buyer should make sure this is in the clone he's considering. The 8087 is a special processor optimized for fast, efficient execution of math calculations. With software designed to take advantage of the 8087's features, the difference in execution speed can be startling. If the 8087 is not present, the calculations can be done using the microprocessor, but this slows down overall processing speed.

The coprocessor is especially useful in spreadsheet programs that do a lot of number crunching, and programs such as AMSAT's latest IBM PC satellite tracking software. When buying an 8087 chip, make sure that it's specified for an 8 MHz clock if the clone has dual speeds.

Automatic Time and Date

A nice feature of the IBM PC is that every time a file is written to disk, it's stamped with the time and date. It's hard to appreciate this feature until the computernik has a hard disk full of files, and can't remember the name of the letter he typed up last night. With the stamp, he needs only to look at the date and time of each file. Whenever the user turns on or reboots the computer, it asks for the time and date. Many expansion boards that include memory, serial communication, and parallel printer ports ("combo" or "multifunction" boards) come with a battery-backed real time clock/calendar chip that takes care of this chore when the user runs a small program inserted on the start-up disk. A battery-backed real time clock is a very worthwhile feature.

Reset Switch

Sometimes a user wishes to reboot the system. Rebooting means clearing *everything* out of RAM, including the DOS system, and reinstalling the DOS. A very common reason for rebooting is because a software crash has locked-up the computer.

A user can reboot his computer several ways. The reboot least stressful for the system—and the one the user should try first—is keystroking the <Ctrl>, <Del>, and <Alt> keys simultaneously. Some software crashes are so major, however, that the computer won't accept any commands from the keyboard. At this point, the user should press the reset button. As a last resort, he should turn off the computer, put the system disk in, and switch it back on.

The IBM PC and all other IBM Personal Computers don't have a master reset switch. Look for this on a clone. Those debugging their own software will appreciate having the reset switch, because the recovery cycle is much shorter than with a power down, and much gentler on the computer.

Keyboard

Those who type a lot, such as those who have discovered the joys of word processing and packet radio communications, quickly tire of using a keyboard with the same layout as the original PC's keyboard. Fortunately, when IBM introduced the PC's bigger brother, the PC/AT, it introduced a keyboard with a much improved layout. Many clone manufacturers, in their ongoing quest to go IBM one better, now include a keyboard with the same layout as the AT with their PC clones.

The PC 8700 keyboard from DataDesk International has received excellent reviews. Another DataDesk keyboard is the Turbo-101 Enhanced keyboard, which features the improvements that IBM has implemented in their latest keyboards (separate function, cursor, and number pad keys) while retaining the large backwards "L" shaped return key. The DataDesk keyboards work with any IBM PC, and virtually all clones. I also heard good words about the Maxi-Switch, a keyboard with the same layout.

Which Display?

There are many articles devoted to the various display options available for the PC. The PC doesn't come with circuitry to drive a video monitor like the C-64 does. What follows is a summary of the wide variety of display options.

The most basic display is the monochrome text adapter. (The adapter is another name for the circuit card that plugs into the expansion slots in a PC or clone and generates the signal for the monitor in use.) The mono text adapter doesn't allow graphics, but does have nice sharp text display. The color of the mono screen is determined by the color of the phosphor of the monitor. Hercules came out with a mono adapter card that could do graphics, but only for those programs written specifically for it—it's not compatible with the color graphics adapter mentioned in the next paragraph. Nonetheless, the Hercules card has become a standard in its own right, in addition to the IBM cards.

The color graphics adapter can display text, graphics, and color and can only be used with a color monitor. Its text display, however, is very grainy and hard to look at for a long time. Those who intend to work mainly with text shouldn't get this card.

IBM then came out with its Enhanced Graphics Adapter (EGA), at a much enhanced price. This, however, greatly improved graphics and text resolution. Fortunately, reasonably-priced EGA clones soon appeared. The EGA is quite usable for both text and graphics.

For all-around use, a Hercules-type mono system is likely the best choice—it's the cheapest and easiest to read.

Selecting a suitable display is one of the few items in buying a computer best left to do personally at a computer store.

Specific Clones

There are some very good deals out there on clones, especially for those willing to deal by mail. Good deals are also possible, however, at the local dealer.

The first is Tandy/Radio Shack. Some of Tandy's computers have the Radio Shack label, others the Tandy label. Tandy, the parent company, has learned a lot about making IBM PC compatible computers. There are many Tandy/Radio Shack Computer Center nationwide that will service these clones.

The user should know, however, of which peripherals he wants to interface with the Tandy. Tandy's 1000 series computers have a reputation of being very hardware incompatible.

Don't think that the only place to buy Tandy/Radio Shack computers is at the local Radio Shack store or Radio Shack Computer Center. Pick up an issue of *80 Micro* magazine and look at the classified ads. There are also several companies selling Tandy/Radio Shack computers by mail as Radio Shack Associate (as opposed to Tandy owned) stores. The same ease of servicing is available to a Tandy/Radio Shack computer purchased through the mail as one purchased locally.

The second is Epson. Epson started out making a very successful line of printers and has now branched out into IBM PC clones. Epson has been fairly successful in getting store and mail-order dealers to carry their line.

The third is Leading Edge. Leading Edge made a big splash with their "Model D"

computer—it was even rated a best buy by *Consumer Reports* magazine! One can also buy Leading Edge's computers through the mail and have them serviced locally. The Leading Edge company, however, are sometimes difficult to get through to for technical support. They refer the great majority of technical inquiries to their dealers, which is a problem when the system or software in question has a problem about which the dealer has no experience.

The fourth is Heathkit/Zenith. Heath/Zenith computers are good, rugged, compatible, and reliable workhorses. Zenith has been doing a booming business selling their computers to the government in large numbers, beating out even IBM with great regularity. The Heathkit counterparts can be built by a hobbyist, just like other Heathkit products. Heath/Zenith computers can be bought through the mail and serviced locally at Heath/Zenith Electronics Centers, or increasingly by local dealers (Zenith only).

The fifth, and last discussed here, is PC Source, sometimes called CompuAdd. Although strictly a mail order vendor, they have some innovative policies that make buying from them a more promising than usual proposition. They offer a free one-year warranty, one year of free technical support on an 800 number, good quality, and reasonable prices.

Although their technical support responsiveness has become more sluggish as the company has sold more systems, it's still head and shoulders above the great majority of mail-order clone vendors.

Build It!

Many people build their own computers. All of the components to build a PC are readily available on the open market.

Be aware of several potential trouble areas. The builder performs the function of a systems integrator, insuring that all pieces of the system work together with every other piece. It's sometimes impossible to know exactly what one gets when buying strictly by mail. There's no dealer tech support service to which to resort. The builder has to scrounge documentation from all quarters. On the flip side, those who select their components carefully and have a mentor can save a bundle of money. *Byte* and *Computer Shopper* magazines are good parts sources.

What's In Cleveland?

Just to give you some examples of what might be available through a local dealer in your area, here are some of my experiences with Cleveland-area computer dealers. One computer distributor sells a clone they themselves assemble. The buyer has no idea who manufactured the components in it, nor does he really care. The main points are that it's IBM PC compatible and locally serviceable.

Another company in the area that used to sell only typewriters is now a dealer for several well respected clone manufacturers. This dealer services the lines they sell, of course, and has many sales offices throughout the Cleveland metropolitan area. Another local computer dealer is run by a ham and distributes a clone that almost no one has ever heard of; but they support it, and it's compatible with the PC, so again, it's a pretty good deal.

Three Vital Accessories

I consider these next few items absolutely indispensable for those thinking about buying (or who already own) a clone. These accessories will end up saving the owner untold amounts of aggravation and money.

The first is *PC Magazine*. Twenty-two issues—one year's worth—is only $25. PC is literally an encyclopedia of PC knowledge, updated every two weeks or so.

The second is the local PC User Group. User groups provide ongoing support and encouragement, usually a newsletter, occasionally a Bulletin Board System, and almost always a public domain software library.

The third is the PC-Software Interest Group. PC-SIG is an organization that gathers, organizes, and distributes public domain software for the PC for a modest fee.

Final Words of Wisdom

Many people get in a pattern of constantly waiting for the prices of personal computer systems to go down, since it does so regularly. For example, IBM recently announced their new Personal System/2 line of computers, which has an unusually good price/performance ratio. The PS/2s, however, don't really offer any features of practical use for the average PC user.

The point is this: If a particular combination of software and hardware will accomplish what the user wants now, he should buy now. Otherwise, he should wait.

Summary

- Make sure it's FCC certified!
- Make sure it has at least 640K of RAM.
- Look for dual clock speeds (4.77 & 8 MHz typically).
- Get dual floppy disk drives.
- Don't try out a hard disk unless you can afford to get one—they're too addicting!
- Make sure the BIOS is legal. The user isn't liable, but it's difficult to get any support.
- Make sure it has an 8087 socket.
- Keep in mind the battery backed clock/calendar option.
- A reset switch, though not necessary, is very handy.
- Look for a keyboard with the same (or better) layout as an IBM PC/AT keyboard. The PC type keyboard is the pits!
- Define the text/graphics use balance before buying the video card.
- Subscribe to PC magazine.
- Join a PC users group. Computer Shopper magazine publishes a list of users groups nationwide.
- Check out PC-SIG. It's quite possible to find all the needed software, except DOS, in public domain software.
- If there's a need, buy the clone now, rather than waiting for something better to come along.

Good luck! If you have specific questions about PCs, feel free to write—SASE please! ■

Further Reading

For further reading about IBM PC clones, check out the following articles, books, and magazines:

Articles

Guttman, Michael. "Zenith 151 Computer," *Computers and Electronics* August 1984, pgs 32–33, 91–93.

Kanter, Elliot S. "PC Compatible Computer," *Radio Electronics*, July 1985, pgs 43–46, 82.

"IBM Compatible Computers" *Consumer Reports*, October 1985, pgs 576–580.

Call, Barbara. "XT Compatibles," *PC Week*, July 15, 1986, pgs 57–67, 73–78.

Stafford, Paul M. "The Cheapest PCs Ever," *PC*, October 14, 1986, pgs *122–146*.

Rutch, Edwin. *The IBM XT Clone Buyers Guide*, $9.95 from Modular Information Systems.

Magazines

PC Clones, 5211 S. Washington Avenue, Titusville, Florida 32780, (305) 269-3211.

PC Resource, 80 Elm Street, Peterborough, New Hampshire 03458.

Addresses 80 Micro, 80 Elm Street, Peterborough, New Hampshire 03458.

Byte Magazine One Phoenix Mill Lane, Peterborough, New Hampshire 03458, (603) 924-9281.

Computer Shopper Magazine Computer Shopper, Inc., 407 South Washington Avenue, Titusville, Florida, 32796, (305) 269-3211.

DataDesk International 7650 Haskell Avenue, Van Nuys, California 91406, (818) 780-1673.

PC Magazine Ziff Davis Publishing Company, PO Box 2445, Boulder, Colorado 80322, (303) 447-9330.

PC SIG 1030-D East Duane Avenue, Sunnyvale, California 94086, (408) 730-9291 or (800) 245-6717.

Microcomputer Companies

Epson America, Inc. 2780 Lomita Boulevard, Torrance, California 90505, (213) 539-9140.

Heath Company, Benton Harbor, Michigan 49022, (616) 982-3200.

Leading Edge Hardware Products, Inc. 225 Turnpike Street, Canton, Massachusetts 02021, (617) 828-8150.

Maxi-Switch Company, 9697 East River Road, Minneapolis, Minnesota 55433, (612) 755-7660.

Modular Information Systems, 431 Ashbury Street, San Francisco, CA 94117, (415) 552-8648.

PC Source/CompuAdd, 12303-G Technology Boulevard, Austin, Texas 78727, (800) 643-0092.

Tandy Corporation, 300 One Tandy Center, Fort Worth, Texas 76102, (817) 390-3700

Zenith Data Systems, 1000 North Milwaukee Avenue, Glenview, Illinois 60025, (312) 699-4800.

Amateur Radio in National Emergencies

How to defend against EMP.

by Jerome T. Dijak W9JD

A while back Wayne devoted a bit of editorial space to lament the lack of amateur radio preparedness to deal with a major national emergency such as a nuclear war. Here are some thoughts on how to better prepare the ham community for emergency situations.

What is EMP?

Nuclear weapons produce short but intense bursts of wideband electromagnetic energy as a by-product of detonation. This phenomenon is called electromagnetic pulse (or EMP). A weapon detonated outside the atmosphere (a burst altitude of 200 km is about "optimum") produces particularly intense EMP, which could disrupt electronic equipment in one third the continental United States.

In radio equipment, antennas, and power lines, EMP produces an effect very similar to a large, near-direct lightning strike. There are many variables, but a good planning factor is to protect against an EMP pulse as one would protect against a direct lightning strike to an object a few feet from his antenna. Many areas of the country are expected to survive the initial thermal and blast effects of a nuclear laydown. Communications equipment in these areas could be usable in the post-attack period. . .if it can survive the EMP effects.

EMP Protection

QST ran an excellent series of articles in 1986 on EMP (see reference 1). These were based on a technical report of the National Communications System that discussed EMP testing and protection specifically for the amateur radio community (see reference 2). This report is available from Office of the Manager, National Communication System, ATTN: NCS-TS, Washington, DC 20305-2010. Request TIB 85-10. I recommend the above to anyone really interested in protecting their station from EMP.

Grossly oversimplified, my guidelines for protecting your ham station from EMP are as follows:

1. Install substantial lightning surge arrestors on all antenna and power lines entering your station.
2. Leave as much equipment as possible completely disconnected from antenna and power lines, whenever possible.
3. Keep spare radios in storage to replace destroyed units.
4. Remember to protect against low-level transients common in any severe thunderstorm. Metal oxide varistors are good for this application.

> *"In radio equipment, antennas, and power lines, EMP produces an effect very similar to a large, near-direct lightning strike."*

It's a good idea, too, to protect against a very close strike, such as one strong enough to fire a gas-discharge lightning arrestor device. It's not feasible, however, to protect radios against a direct lightning strike. A good arrestor will help, at least, to prevent a major fire.

Be Prepared

There are several other steps one can take to better prepare to help out in a national emergency.

First, a ham should prepare himself and his station to survive and operate for several days (or better yet, weeks) in the event of a major natural disaster. Depending upon location, this may be blizzards, hurricanes, tornadoes, or earthquakes. A ham with this capability—which is not easy to attain—can be a valuable resource in a wide range of emergencies.

Second, learn how to handle third-party message traffic in the disciplined environment of the NTS (National Traffic System) (see reference 3), Military Affiliate Radio System (MARS), or other formal traffic nets. In a real time of need, people with these skills will be much more effective in passing information all over the country in an organized manner. The federal government will have a great need to send messages throughout the country in any massive emergency, and they will be glad to have them handled by amateurs (with the help of the net infrastructures), if it can get the job done.

Learn to receive and relay traffic with perfect accuracy regardless of whether or not the text makes any sense. Government messages will likely be encrypted before they are handed over to the ham community to relay, so the texts may be apparently random letter groups.

Third, learn as much as possible about nuclear weapons effects, fallout characteristics, and radiation sickness. There are a number of steps to improve survivability.

Summary

The amateur radio community is a very flexible and resourceful asset to the nation. They have long- and short-haul communications capabilities. This community has a great potential for surviving even the most severe regional or national emergencies, and providing great assistance to community, regional, and national leaders in time of crisis.

References

1. Bodson, Dennis W4PWF, *Electromagnetic Pulse and the Radio Amateur, QST*, Aug.–Nov. 1986, four-part series.
2. *Electromagnetic Pulse/Transient Threat Testing of Protection Devices for Amateur/Military Affiliate Radio System Equipment*, National Communications Systems, Oct. 1985.
3. *The ARRL Operating Manual*, American Radio Relay League, any recent year.

Jerome W9JD is a PhD electrical engineer, and has previously done research for the US Air Force in the field of lightning and EMP effects on aircraft. He is currently a Lieutenant Colonel and serving as Chief Engineer for Communications-Electronics at the National Emergency Airborne Command Post. He's been an amateur for 23 years.

Number 13 on your Feedback card

Stone Mountain Engineering
P.O. Box 1573
Stone Mountain, GA 30086
404-879-0241
Price: $89.50

73 Review *reviewed by Bill Clarke WA4BLC*

Finger Tip Frequency Control

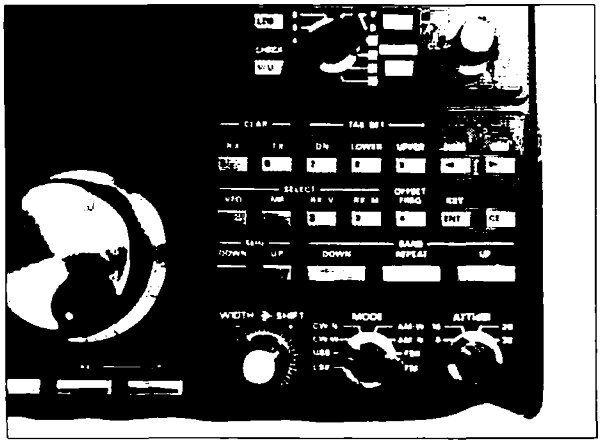


Photo A. The keyboard used for frequency entry on the Yaesu FT-980.

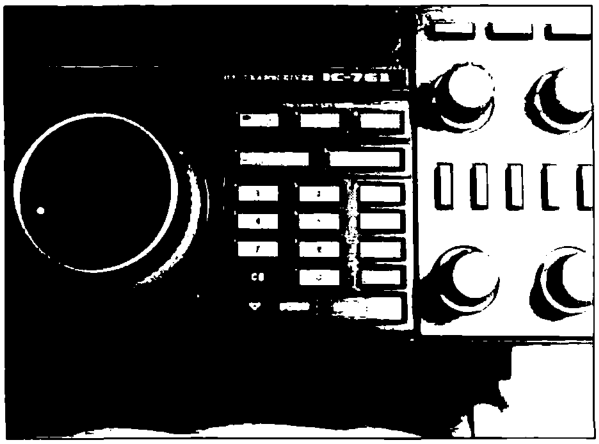


Photo B. The ICOM-761's keypad is responsible for my interest in direct keyboard frequency entry.

Frequency determination of transmitters and receivers are always a problem for the ham. In particular, the accuracy of tuning dials are always questionable.

In the fifties, Collins radios had 1 kHz markings on the dial. That was accuracy! It was also state of the art, and considering that other radios were read by estimation of marks, the readings were sometimes as far apart as 10 kHz. In the seventies the range turned to digital readout, with its inherent accuracy. Of course the common link between these radios was the tuning knob. The interest now is to replace the great round knob and turn toward direct keyboard frequency entry, via a keyboard.

My first experience with digital frequency selection came last summer when I was asked to review the ICOM IC-761. That was the first experience of direct keyboard frequency entry on that radio. I have since become a proponent of its convenience.

What Is It?

Digital frequency entry means controlling the transceiver's frequency from a key pad. The key pad may be similar to that found on a fancy HT. Its use is very simple, for example, if tuning the rig to 7.255 kHz, the appropriate buttons on the key pad would be pressed. Immediately the rig displays the input frequency and is ready to operate.

Where Is It?

In the accompanying photographs, look at the panel mounted key pads found on top of the line HF transceivers. Additionally, there is a remote key pad by ICOM for use on the 751 and 751A. Well, how about the ham owning some late model CPU- based transceiver that does not include a digital pad on the panel or as an option?

Not to worry! A fellow way down in Georgia has come to the rescue. He is Mike Huddleston KJ4LN, of Stone Mountain Engineering. His product is the QSYer.

The QSYer

The QSYer is described in Stone Mountain's brochure as a commercial quality key pad. It is specified for one million operations, inclined to a 10 degree angle for comfort and speed. The unit contains its own 8 bit microprocessor, support circuitry, and even a small speaker for audio indication of key press.

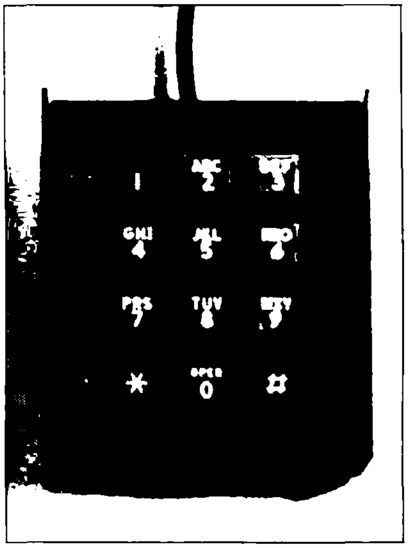


Photo C. The QSYer, available for use on most current HF transceivers.

The metal enclosure is 3.1 x 3.5 x 2 inches and has a single shielded cable running from it to the transceiver. The QSYer requires 13 VDC to operate. The power may be taken from a transceiver or from an external DC power supply.

What does the QSYer do? It allows the user to let his fingers take control of the late model transceiver. Just punch the buttons for the frequency desired to operate on. Instantly, the user will be there.

Band to band, frequency to frequency. It is all possible with the QSYer. Best of all, the QSYer does not replace, or even interfere with, the main tuning knob. Rather, they accent one another. The main tuning knob is still there for roaming around and for fine tuning.

If the rig is connected to an automatic antenna tuner, that will be controlled from the key pad, too. Mode is also automatically selected, if the particular transceiver offers this feature. For example: The ICOM 735 selects USB, LSB, and FM, depending upon what frequency is selected. Thus, when a frequency is selected, the radio will assign the mode. QSYing has never been easier. ■

The QSYer is available for the following HF transceivers:

ICOM	Yeasu	Kenwood
IC-735	FT-757	TS-940
	FT-757/GX II	TS-440
	FT-767	TS-140

Table 1.

minute as it is five—or, for that matter, twenty. Indeed, I don't think it takes much longer to learn to copy the code at 50 wpm. One of the worst known ways to try and learn the code is to start slow and gradually build up your speed. This system works against the basic way our mind operates, so this stupid system has lost amateur radio hundreds of thousands of potential hams. I can hear you muttering "good riddance." Why spend weeks struggling with something that can be done in hours?

I mentioned the *73 Magazine* code practice tapes that I fiendishly designed to be ball breakers. When you're able to copy my tapes, you'll float happily through any license test. I have one at 6 wpm, one at 14 wpm, and one at 21 wpm, all so rotten that you'll never forgive me. I suggest you start with the 21 and forget the others. Why bother to learn the code two or three times when you can do it once and have it done with?

At the higher speeds you get used to the sound pattern of words more than characters. You'll get to know how the more commonly used words sound. And, since most ham contacts are almost totally rubber-stamp, about all you'll have to decipher is the call, name, and location. If you aren't too cheap to spring for a callbook, you won't even have to copy the name and location, just the call.

But, golly gee, wouldn't a no-code license make ham radio like CB? Not if we do it my way, with a tougher technical exam. Of course, the whole license exam thing is a sham in many areas. Extra Class licenses are going for about $150 now, with no bother about the code or even having to know an ohm from a volt. Several of my Puerto Rican friends collared me, saying that several thousand licenses had been sold there. And I've solid evidence that this is happening elsewhere, with the local amateurs hushing up the scandal. Hmmm, 5,000 licenses at $100 each is a half a million bucks! These VEs may be about the only ones making money in our hobby.

As much as I hate what they're doing, imagine how bad our drop in ham growth would be if we didn't have VEs selling licenses! The FCC figures showed a drop of 35% in new licenses in the last three years—check it out in the *W5YI Report*.

NIAC

I also mentioned my proposal to the ham industry that we form a new National Industry Advisory Committee to work with the FCC toward amateur growth and the preservation of our bands. I'd contacted the FCC and had a letter expressing their interest and cooperation. We sure could use some extra input to the Commission these days.

> ***"The Hamvention people tell me I pull the biggest crowd of all at my talks."***

Having been a member of an earlier NIAC for many years, I know how important such an organization is, both for amateur radio, the Commission staffers, and the Commissioners. The last thing we need is the FCC working in an information vacuum.

I'll let you know as the new NIAC develops. At the Dayton ham industry meeting, I got an enthusiastic response to the idea, and offers from many key ham industry people to help. To fund the project, I proposed asking all ham industry firms to contribute $100 a year. I got dozens of positive responses to this idea and only two negative.

I proposed that the NIAC group meet at the Orlando hamfest in the winter, at Dayton in the spring, Atlanta in the summer, and in Washington, where we could get together with the FCC, in the fall.

Digital Audio

Then I got to talking about some of the newer technologies I see coming along. One that has great promise is Digital Tape (DT... as in DAT, where the data is translated into digital audio). I see markets for a wide variety of hardware, software, and information products for this technology. I predict this will grow from zero into a $10 billion industry within ten years.

DT should be great for amateur radio applications. For instance, if one wanted to send music, 3D high definition photos or a data base over a 20 meter phone channel, all one would have to do is slow down the DT by a factor of 20 and send away. This is simple—you can dump 640K of data from DT into RAM in 3.5 seconds, and then send it at any rate you want over the air. You put it back on DT and then play it at normal speed. With a packet system this would all be automatic. Even movies can be sent this way, substituting time for bandwidth.

Since it's unlikely the old men who make up most of our ranks today even have a working soldering iron, this brings us back to the need for youngsters in the hobby. It was mentioned at the industry meeting that 63% of all scientists made their decision for science by the time they were in the 6th grade. This was right in line with my proposal to get courses started in every school in America, grades 5–12, teaching the fundamentals of electronics, communications, and computers.

Just a couple days before Dayton, I had an opportunity to talk at length with the chairman of the National Science Board (NSB), the group that runs the National Science Foundation (NSF), a government group that doles out something over $220 million a year promoting science. Yes, of course I explained my idea. I'll let you know what develops from this.

Ham Radio In Schools

I'm also angling for a meeting with Secretary of Education Bill Bennett to talk over this and a few other ideas with him. If I can get some basic courses in communications into the American schools, we'll have the kids we need to get amateur radio growing again—and perhaps, even our American electronic industries.

Is it really possible that we might have as many as a million new hams a year? I think so.

Get Our Elected Where It Counts

You know, if you'd help, we might have a whack at it. It costs about $100 to get the undivided attention of a congressman. Oh, it probably isn't the $100 that gets the attention as much as the perceived potential for more. Congressmen tend to have three major priorities. 1. Get re-elected. 2. Get re-elected. 3. Get re-elected. Beyond that, the priorities get fuzzy, often tending to bow to the breezes from lobbyists. Thus, if you send along a little donation toward the next re-election campaign, you could use the attention this generates to get my ideas read. But please hold your money until we're set to go.

I brought up the new communications technologies that we amateurs should be developing. We've the potential right now for setting up a system that has a throughput of 500 pages per second. No, you can't read that fast, but that means you can send one page in two milliseconds. With that kind of throughput, twenty thousand ops could use one single channel without any problems. It's almost enough to make one think. Well, if we don't get some youngsters into our hobby and turn them loose on pioneering like this, we'll have to read the Japanese ham magazines to find out how to do it. That what you want?

More Building!

Oh, yes, Dayton. I mentioned that I'm very interested in getting as many articles as I can for *73* on home construction projects. With the rising interest in QRP, how about some simple rigs and transceivers? Also, I'm interested in articles on transmitter hunting—equipment, techniques. How about some articles on using the new SSTV telephone units from Mitsubishi and Sony? They should be fantastic for amateur radio. And with FAX going into offices everywhere, how about more articles on the ham use of FAX?

If you get a new piece of ham gear and think it's worth telling others about, you might see if we're interested. I'd rather read about real ham opinions of new gear than most of the technical reviews I'm seeing in the other magazines. How is it to use? I don't want to know how to build a watch as much as I want to know what time it is.

Love and Hate

Since I've heard there are a bunch of Wayne Green haters out there, I thought I'd take advantage of this and have stickers available at Dayton. Half said "I Love Wayne"—the other half said "I Hate Wayne." How anyone can hate someone as lovable beats me, but I've heard ugly rumors. I keep hoping a hater will come to one of my talks and speak up.

The stickers were popular. I wonder how much they'll go for in a few years? People collect the darndest things. Good collector's item.

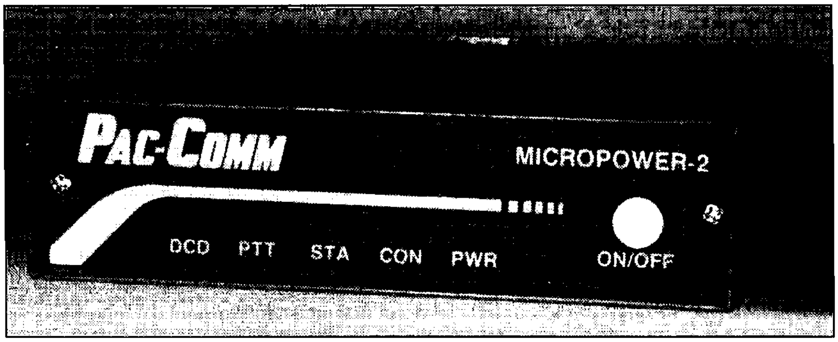
If you missed me at Dayton this year, let's try it next year. Let's pack that room until the fire marshals complain. 73

73 Review *by Jozef Hand-Boniakowski WB2MIC*

Pac-Comm Micro Power TNC

Go Packet Portable with the μ2AT and Tandy T-100!

Pac-Comm
3652 W. Cypress St.
Tampa, FL 33607
Price: $160



Pac-Comm's Micro TNC. Ideal for any station, portable or fixed.

A little over a year ago, I wrote a review for *73 Magazine* on the ICOM μ2AT, 2-meter hand-held transceiver, a unit by which I was, and am still, impressed. As I finished putting together that review, I began to think: How soon will hams see a packet station using the low power consumption of a rig like the μ2AT? Well, that time has come already—read on to find out about such a *small*, versatile, and easy to operate station.

The Need

I have been involved with packet radio for over three years. I have set up an educational network called COSIN, the COmputer Student Information Network. This revolves around WB2MIC-7, a fully windmill-powered, 130-watt output digipeater atop Northeast Mountain, Vermont (2,400 ft ASL), and WB2MIC-4, a dual-ported educational bulletin board system. The BBS runs KA2BQE PRMBS code in "C," a spectacular bit of software. I needed a portable demonstration station I could bring to schools, science exhibits, demonstrations and, of course, for emergency operation, fun and recreation.

COSIN uses three AEA PK-87s. They work flawlessly, but were too big and power-hungry for portable packet. I tried the GLB PK-1L, but, not having the standard TAPR TNC-2 command set, I was quickly disappointed.

Finally, I noticed the ad for the Pac-Comm Tiny-2 and Micro TNCs. The Micro is as small as its Tiny brother, but rated at very low power draw. Having good luck with Pac-Comm's DR-100 and DR-200 dedicated digipeaters, I didn't hesitate to buy a Micro TNC.

Description and Specs

The Micro is smaller than most TNCs, though—at 5″ x 7″ x 1⅜″ and 22 ounces—bigger than GLB's PK-1L. The Pac-Comm Micro has a nice gray extruded aluminum cabinet with a wrinkle finish. The front panel is a thin, flexible plastic plate. On it are five LED indicators, labelled DCD (Data Carrier Detect), PTT (Push-to-Talk line), STA, CON (Connect), POWER, and the power pushbutton. The rear panel has a 9–12 VDC jack, 5-pin DIN connector for radio hookup, TTL level connector for hookup to computers such as the C-64, and DE-9P nine-pin connector for standard RS-232C levels.

The Micro has several improvements over previous models. Just above the opening for the TTL level connector, there is easy access to the trim pots that adjust the radio drive and modem bias levels. This is a welcome change from Pac-Comm's previous designs, where the entire TNC circuit board had to be removed from the cabinet to make the TX audio level adjustment!

Another improvement was the method of removing the circuit board from the cabinet. In the DR-100/200/TNC-220 series, the regulator transistor was fastened to the extruded aluminum cabinet with a self-tapping screw. The user has to loosen this screw to remove the board from the cabinet. Many regulators fry because users forget, or don't realize, that the cabinet serves as the heat sink for the regulator.

> ***". . . there's easy access to the trim pots that adjust the radio drive and modem bias levels."***

This isn't the case with the Micro. The packeteer just needs to loosen two screws, and the back panel (also made of plastic lined on the inside with a metallic shield) comes off. The board slides out easily, exposing all DIP switches that set the radio, and computer, baud rate. Newer models have metal back panels, and in July Pac-Comm began shipping units with metal front panels, too.

All the microchips, thank goodness, are socketed. The components are high quality and the workmanship is excellent. The only shortcoming is the fuzziness of the silk screening identifying the components and jumpers. (Pac-Comm has since corrected the silk screen problem, which only occured on a run of 300 boards.) I had to look very carefully to make certain the jumper I was looking for was the correct one for the lithium battery backup. This battery is for maintaining parameters that are entered into the TNC and such things as the beacon and connect texts.

Micro TNC To The Task

I hooked up the Micro to my wife's ICOM μ2AT and Tandy Model 100 computer. I used two 6-volt 2.6 amp-hour gel-cells in series supplying power to the TNC and tapping in the middle for power to the computer. I made up the cables per the manual instructions (more on this document later) and placed everything strategically inside a Radio Shack carrying case for the Model 100. All fit very easily with room to spare for a log book, spare connectors, AEA Hot-Rod collapsible ⅝-wave antennas, and electrical tape.

From the first power up, everything performed flawlessly. The very first contact was through COSIN's ten-meter gateway from 145.07 to 28.105 MHz. I was sitting on my porch having a QSO with a ham in South America on packet radio running 100mW!

The Micro draws about 38 mA, within the published specifications of 40 mA. It's a sheer pleasure to use and does everything a packet radio terminal node controller is supposed to do, and more.

A Little RFI

My only complaint is that my unit is a bit "noisy"—RFI from the Micro showed on the LCD S-meter read-out of the µ2AT. This, however, didn't affect operation. My guess is that RFI was getting into the handheld at the radio's IF frequency. Nonetheless, I could minimize RFI by moving the HT further away from the TNC and working up a better shielded cable. Later models have an RF choke in the power input circuit to reduce RFI from the units. Pac-Comm offers owners of older units free upgrade kits.

Watch also the shielding when configuring the Micro to use with the ICOM AT/0AT/µAT-series HTs. These HTs use one electrical line for both TX audio and PTT, so a small circuit is needed to separate the two signals from the HT.

One lead of a .01µF ceramic disk capacitor was soldered to one end of a 27k⅛-watt resistor. This common lead was connected to the HT's external microphone jack at the tip. The free end of the resistor went to the TNC's PTT line while the free end of the capacitor went to TNC's TX audio line. I placed these components originally on a vector board mounted close to the HT and soon realized that this break in the shielded cable was a major source of RFI. Mounting the components inside the shell of the 5-pin DIN plug greatly reduced RFI.

One-Time Mystery

The only initial problem with the operation of my Micro was the loss of anything other than ROM default parameters at power down. MY CALL WB2MIC-6, the beacon, and connect text, was lost as well as any other keyboard changes. This prompted me to look inside the Micro for the jumper to the lithium BBRAM (battery backup random access memory) battery jumper. Upon removal of the jumper, and replacement, this condition disappeared. This was apparently an anomaly with my unit. Pac-Comm has not reported this problem elsewhere, and BBRAM reset is not normally required.

Extras

The Micro functions are similar to other TNC-2 type TNCs, so I'll discuss just the added features. The Micro allows for "HEALTH" features. By using the command HEALLED ON, the CON and STA LEDs give up their normal functions and take on the role of indicators for the condition of the processor in the packet controller. The two LEDs blink on and off in a random pattern when all is well and the processor is executing the software properly. The command HEALLED OFF is used to bring the CON and STA LEDs back to their normal function. In addition, a packeteer can monitor numerous parameters by looking at the 17 available counters, each 16 bits wide. The command DISPLAY HEALTH causes the Micro to reveal the counter names and their settings. One of the more interesting counters is BBFAILED which counts the times that the BBRAM checksum was in error. Other examples of counters include ASYRXOVR (indicating data from user being lost), and DIGISENT (keeps track of the total frames digipeated).

Manual

Pac-Comm has come a long way from the days of TNC 200 and 220—and the manual is no exception. No longer does a newcomer (or experienced forgetful user) have to second-guess the tech writer's intent. The two-part manual—for operation and hardware reference—is concise, well written, and well organized. It clearly explains all commands, features, interfacing wiring and usage instructions, with illustrations where appropriate. It's obvious the manual is a dedicated guide to non-frustrating packet setup and operation. There's even a section explaining the physical and link layer protocols for those inclined to learn. Also included is a detailed circuit description and a troubleshooting section. There is a full-size circuit schematic and detailed diagrams of all connectors, pin-outs, and wiring to various system configurations at the end of the manual, which is spiral bound and small enough to fit into the Model 100 carrying case. A pull-out summary sheet of all TNC commands is supplied.

Conclusions

The Micro is fully compatible with the latest version of NETROM software for level 3 use and is readily adaptable for use with high speed modems like the 19.2kB AEA backbone tracking modem/radio combination.

I am very favorably impressed by the Micro. To date, three local members of COSIN have purchased the Pac-Comm Micro and are completely satisfied. I highly recommend this Pac-Comm unit for home use, as a low powered dedicated digipeater, NETROM switch or BBS controller to use with a host computer. The unit performed flawlessly in each capacity. Pac-Comm has a winner. Now, how do I convince my wife, Jeanne KA1PMS, to trade my big IC-02AT for her µ2AT? Instead of the swap, I may well set up another portable packet station and buy another one of these little wonders. 73

Number 15 on your Feedback card

MODERNIZING THE SB-200

Necessity is the theme and the inventress, the eternal curb and law of nature.
—Leonardo Da Vinci.

by Bill Clarke WA4BLC

Heathkit for many years sold an amplifier kit called the SB-200. It was a 1200-watt PEP unit that used two 572B tubes. Although these amplifiers now have some age on them and are no longer produced, it is by no means the end of them.

A ham can usually find used a SB-200 for about $300. Its true value depends upon how well the kit-builder put it together, and cared for it and its final tubes. The careful shopper can find a solid unit at a large cost savings over the purchase of a new amplifier using the 3-500Z tube (also a 1200 watt PEP amplifier).

Of course, many types of older equipment need improvements and modernization to function in today's stations. The SB-200 is no different.

The operator must modify the SB-200's keying circuit to use with modern solid state transceivers. The problem is that the voltage present on the relay jack exceeds that allowed by the amplifier keying circuits of most new transceivers. Trying to key the SB-200 with a new transceiver will most likely damage the internal relay. Repair costs are *at least* $50.

Update It!

This article outlines the procedure to update the keying circuit and adding status lights. The result is a more modern-appearing amplifier that one can key with any solid state rig. The cost for the parts is about $20, and the time spent should be less than two hours.

275-213	Relay	$3.99
275-663	Switch	2.89
272-332	Red lamps	1.69
272-335	Blue lamps	1.69
276-1180	Rectifier	2.19
273-1352	Transformer	4.99
272-1048	Capacitor	3.49

Table 1.

"A ham can usually find a used SB-200 for about $300."

Parts List

The modification is completed with parts from Radio Shack. Part numbers are given in Table 1.

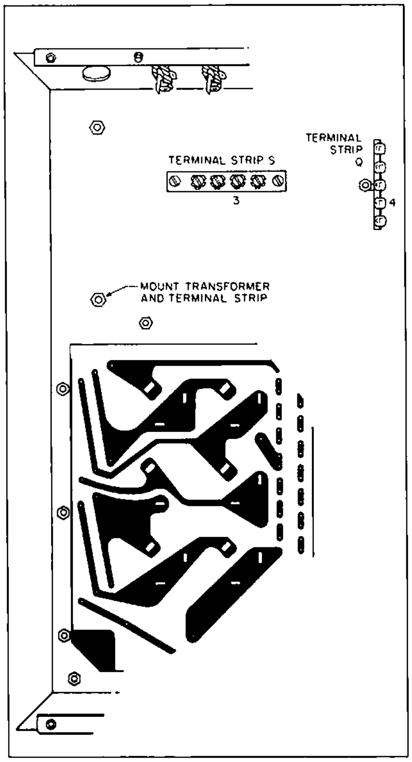


Figure 1. Diagram of the inside bottom of the Heathkit SB-200 linear amp.

Instructions

Just a few short steps will modernize the SB200. Before proceeding, make sure the amplifier is unplugged! Then remove the case.

First mount the new transformer to the transformer mounting bolt on the bottom of the chassis as shown in Figure 1. Then install a 5-lug terminal strip (TS) on the same bolt as the new transformer. This terminal strip will be referred to as TS. Glue the relay to the chassis (terminal legs up) near the new transformer.

Now solder the rectifier's AC legs to TS lugs #1 and #2. Solder the rectifier's positive (+) leg to TS lug #4, the rectifier's negative (-) leg to TS lug #3, and the new transformer's secondary leads to TS lugs #1 and #2.

Isolate the new transformer's secondary center tap lead. It won't be used.

Then solder the new transformer's primary leads to terminal strip S lug #3 and terminal strip Q lug #4 as shown in Fig. 1.

Solder the positive (+) lead of the filter capacitor to TS lug #4 and the cap's negative (-) lead to TS lug #3.

Drill a ¼-inch hole about two inches left of the meter function selector knob (on the front panel), and mount the DPDT switch. Then run a wire from relay terminal #1 to TS lug #4 (see Fig. 3) and solder.

Run a wire from relay terminal #5 to switch terminal #2 (see Fig. 2 and 3) and solder. Unsolder the leg of R16 that is attached to the center conductor of the relay jack on the rear panel. Then solder R16's leg to relay terminal #4 (see Fig. 3). Run a wire from relay terminal #2 to TS lug #3 and solder. Run a wire from switch terminal #1 to the center of the relay jack on the rear panel (see Fig. 2) and solder.

Now drill a ½-inch hole about 1-½ inches to the left of the DPDT switch and install the red lamp. Drill a ½ inch hole about one inch to the left of the red lamp and install the blue lamp.

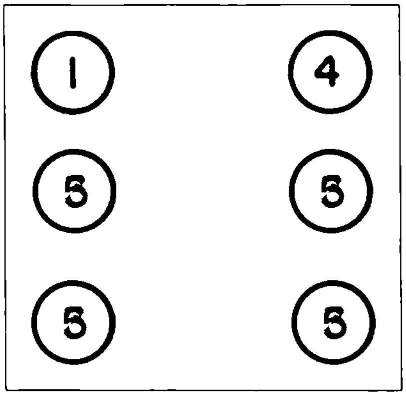


Figure 2. DPDT switch terminals.

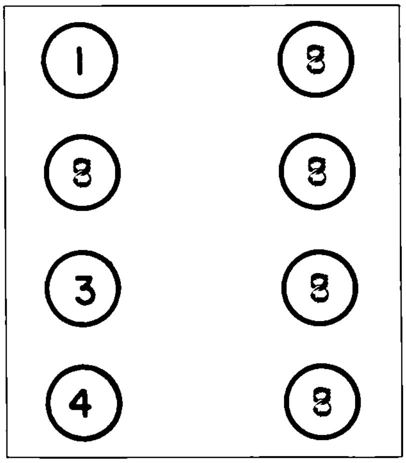


Figure 3. Relay terminals.

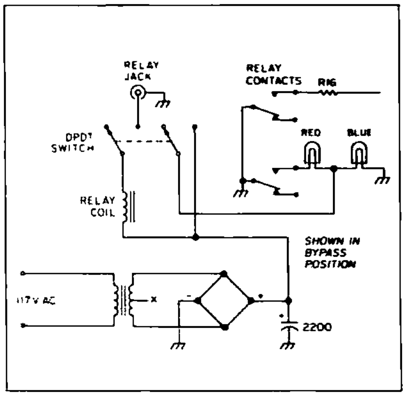


Figure 4. Schematic of SB-200 modification. It brings amp key relay terminal voltage down to a level acceptable to most current solid-state drivers. It also installs an amplifier by-pass switch.

Solder a lead from the red lamp to switch terminal #5 (see Fig. 2) and solder the remaining red lamp lead to relay terminal #8 (see Fig. 3). Next run a wire from relay terminal #6 to TS lug #3 and solder.

Run a wire from switch terminal #5 to TS lug #4 (see Fig. 2) and solder. Also solder a lead from the blue lamp to switch terminal #5. Then solder the remaining blue lamp lead to TS lug #3.

This completes the installation steps. Double and triple check the work.

Use of the Mods

The newly installed switch allows instant amplifier by-pass. Heath's original thinking was that since the 572B tubes are instant heating, the user can switch them off during any amp inactivity. I don't subscribe, however, to the policy of turning off electrical equipment on and off at every moment when it's not needed. The power up/down action is very stressing to equipment and causes excess wear.

When the new switch is in the OFF position, it's not possible to key the amplifier, and the new pilot lamps will be off. Only the SB-200's meter lights will be on.

Place the switch in the ON position and the blue lamp will come on indicating the amplifier is now ready to use. When the transmitter is keyed, the new relay will close (activating the amplifier keying circuit) and the red lamp will light.

Other Mods Are Possible

I suppose the list is endless of what one might do to an older piece of equipment to make it suit their tastes. Here are a few ideas:

- The addition of a better cooling fan, such as a 4-inch muffin fan.
- Operation on the 160-meter band.
- Vernier turns reducers for the knobs.
- An improved meter function switch.

The moral is this: Those willing to take the time to check out older equipment carefully and spend a little soldering time will most often get a fine piece of equipment at a huge savings.

Who can balk at a 1200W amp, usable with today's HF drivers, for $350 and a few hours worth of their time?

Good luck!

Soldering Sidebar

Tips to master soldering techniques

by Larry Antonuk WB9RRT

Once you've mastered basic soldering techniques (you did read that booklet from Heathkit, didn't you?), keep the following tips in mind:

1. Use enough heat. For most PC board work, this means a 45-watt pencil. Use a big enough iron, and regulate the amount of heat by controlling the time that the iron is in contact with the joint. If you have to wait more than two seconds to heat a PC board connection, more wattage is needed. For a UHF connector the large-tipped 40 watt pencils (similar to Weller WP-40) work fine.

2. Be clean. Wipe your soldering iron tip on a damp sponge. Make sure your wires, PC pads, etc., are spotless. If you're resoldering burned wiring, strip the wires back to clean copper. On a PL-259, scrape the area around the holes with a small file or pocket knife. Don't count on the flux to do your cleaning for you.

3. Use the proper solder for the job. For most electronic work, use 63.37, or "eutectic" solder. Eutectic solder has a very small "plastic" range, which helps prevent cold solder joints. Heavy current or high temperature connections require a high melting-point solder–usually a tin/lead/silver alloy. Use ONLY rosin core solder.

4. Clean the flux from the PC board when finished. Use alcohol and a trimmed plumber's flux brush. (The use of flux removers on boards containing surface-mounted devices is not recommended.)

5. Know what you're soldering. If you have enough heat and a clean connection, and things still aren't working–check your materials. Some of those stainless steel straps on some battery packs will not accept rosin core solder. To solder stainless steel, you'll need some "tinner's flux," available at most hardware stores. A drop will allow proper wetting on stainless. (Tinner's flux is highly corrosive–exercise caution when using it, and thoroughly clean all connections once you're finished.)

6. Yes, Virginia, you can solder wires to aluminum. The reason that you normally can't is that aluminum forms a thin layer of oxidation whenever it's exposed to air, which prevents proper wetting action. To overcome this, thoroughly clean the area to be soldered. Place a few drops of motor oil on the cleaned spot, and scrape the cleaned area with a screwdriver blade. The oil prevents the oxidation layer from forming. Using a LARGE iron, solder the wire to the aluminum in the normal fashion. While somewhat of a mess, this procedure might allow you to save an otherwise unusable antenna element, etc.

Oscilloscope Preamplifier

A little about op amps and video amps

by Frank C. Pugh

This article details the basic theory of operation of a video amplifier and the construction of a practical video amplifier project. I built this project to expand the sensitivity of an older oscilloscope. Before I begin a discussion on "video amplifier theory," a short review of operational amplifiers (op amps) is useful.

Basic Amplifiers

An amplifier is an electronic circuit containing Bipolar Junction Transistor (BJT) and/or Field Effect Transistor (FET) devices. These types of amplifier circuits usually come packaged as ICs. These IC amplifiers generally provide voltage or current gain. They may also provide power gain or allow for desired impedance matching.

Amplifiers have many classifications. There are low-frequency amplifiers, audio amplifiers, ultrasonic amplifiers, radio frequency (RF) amplifiers, wideband amplifiers, op amps, and video amplifiers, each type operating within a prescribed frequency range or in a predetermined fashion.

Op Amps

An operational amplifier is a highly sophisticated linear integrated circuit, a direct current amplifier demonstrating high gain, high input impedance, and low output impedance. Originally the term referred to high gain, high performance, vacuum tube direct current amplifiers. It was designed to perform mathematical operations with predetermined voltage levels. Op amps were the basic building blocks of analog computers, because they could perform the mathematical operations of multiplication, addition, subtraction, integration, and differentiation. The op amp used today can still be used to perform these operations, and now also work in other useful circuit designs. In combination with nonlinear elements such as diodes, they may be used as limiters, level detectors, and nonlinear function generators. By designing op-amp circuits that include other active components, such as transistors, it's even possible to multiply and divide analog voltages by taking the logarithms and anti-logarithms of input voltages.

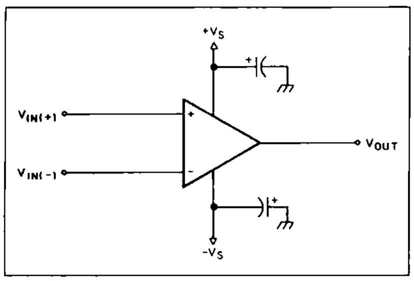


Figure 1. Schematic symbol of a typical op-amp.

> ***"The op-amp is the most commonly used integrated circuit in the industry today."***

The modern day device tends to operate at lower voltages and does not have any of the common problems associated with vacuum tubes. Today's op amps are in integrated circuit formats and still resemble the high gain direct current amplifier which uses external feedback for controlled responses. Users working with op amps see that they adapt well to a variety of industrial applications. They can be designed to function as filters, oscillators, pulse modulators, peak detectors, signal-function generators, small signal rectifiers, instrumentation amplifiers, and a seemingly endless variety of specialized circuit applications. The op amp is the most commonly used integrated circuit in the industry today.

The op amp schematic diagram looks like a triangle. (See Figure 1). There are two input terminals used to correctly address input signal information to the op amp. They are traditionally drawn on the left-hand side of the schematic symbol as represented in Figure 1. The input terminals are connected internally to a differential amplifier located inside the integrated circuit package. These terminals are the inverting and noninverting inputs and carry the symbols − and + respectively. The device also has one output terminal, located at the apex of the triangle, on the right-hand side of the schematic symbol.

Under normal operating conditions, an AC signal applied to the inverting terminal (−) with reference to ground is 180 degrees out of phase with the output signal. This inversion may be difficult to see with a single trace scope. A dual-trace oscilloscope, however, compares the input with the output signal, making the phase shift easy to see. An AC signal applied to the noninverting terminal (+) with reference to ground is in the same phase as the output signal.

Of course, the op amp needs supply voltages and external components added to operate correctly.

Circuit Configurations

Circuits using op amps commonly display properties radically different from those of the individual devices themselves. For example, the circuit's closed loop gain, A_{Cl}, is only a fraction of the device's internal open loop gain, A_{Ol}. In addition, the circuit input impedance is often much different than the operational amplifier's internal input impedance (although for some circuits it will be the same magnitude). Output impedance of the op-amp circuit is usually less than the op-amp device, but the bandwidth is usually greater in op-amp circuits. It's best then to make the first analysis of this circuit assuming an ideal op-amp situation, and then to modify the analysis for the imperfections in the real world of circuit design.

The ideal op-amp has the following five characteristics:

Infinite open loop gain	A_{Ol} = infinite
Infinite input impedance	Z_{IN} = infinite
Zero output impedance	$Z_O = 0$
Zero offset voltage	$V_{OS} = 0$
Zero bias current	$I_{IB} = 0$

The previous assumptions are by no means complete. They are, however, the values which influence most other characteristics. The approximations simplify the analysis of operational circuitry. For example, the assumption of an infinite input impedance allows the experimenter to ignore the loss of any signal current into the amplifier's input terminal. The lack of bias current enables him to neglect the effect of this variable. Designers can apply these assumptions to many circuits.

Video Amplifiers

The video amplifier's characteristics are similar to those of the garden variety op-amp. Typical performance differences between the op amp and video amplifier are superior bandwidth and gain characteristics. Whereas both devices share "ideal" characteristics of infinite gain, zero output impedance, infinite input impedance, and an offset of zero, the video amplifier averages a typical bandwidth between 50 and 90 MHz. This compares very favorably with the bandwidth average of 100 kHz for typical op amps. Some video amplifiers have bandwidths as high as 100 MHz.

The gain of a video amplifier is usually adjustable between 0 and 400, which translates to 50 dB. This compares to 100 dB for op-amps. The internal phase shift of the video amplifier doesn't allow the use of negative feedback to control gain. Therefore, most video amplifiers display a limited output voltage swing. For high-frequency operation, the output voltage swing is typically limited to just a few volts.

"Some video amplifiers have bandwidths as high as 100 MHz."

Input stages of common video amplifiers are designed so that, with the addition of a few external reactive components between the gain select terminals, the gain is easily varied. The video amplifier IC can be made to function as a high-pass, low-pass, or band-pass filter by altering the external reactive elements between the gain select terminals. If a potentiometer is placed between these terminals, the gain can easily be adjusted.

This project's differential video amplifier is the SK9017. Another integrated circuit is the NE592, manufactured by Texas Instruments. The SK9017 and the NE592 are similar video amplifiers that provide selectable amplification. Most video amplifiers have selectable gains of 10, 100, or 400. In addition, most video amplifiers have adjustable passbands. Study the manufacturer's specifications when planning to substitute another integrated circuit for the specified one. Specification sheets are readily available from the manufacturer or component dealer from whom the builder bought his op amp.

When reviewing the manufacturer's specification sheet, the designer sees that the input stage of the video amplifier consists of a basic emitter-coupled differential transistor pair connected to a constant-current-source transistor configuration. This arrangement is typical of video amplifiers available today.

Oscilloscope Preamplifier

A circuit containing a single SK9017 video amplifier, which is the only active component, can be used to increase the sensitivity of an older oscilloscope or frequency counter. The circuit in Figure 2 shows a circuit which provides about 20 dB voltage gain with a frequency range from 0.5 to 50 MHz.

The builder can extend the low-frequency response of this circuit by increasing the value of the 0.05 μF capacitor (or try removing the capacitor). This capacitor connects in series with the input terminal. Another advantage of this circuit is that it delivers a particularly small level of input noise, measured at approximately 20 μV over a bandwidth range of 15 MHz.

The gain is calibrated by adjusting the gain potentiometer connected between pins 3 and 10, as shown in Figure 2. One can adjust the 1 kΩ trimmer potentiometer for an exact voltage gain of 10, which helps preserve the scale factor of the oscilloscope.

Wiring Precautions

The mechanical layout of this oscilloscope preamplifier is very important. Keep all leads as short as possible. When using a PC board for this project, keep all foil conductors as wide and short as practical. This PC board technique helps provide a low resistance and low inductance signal path. It also minimizes stray signal feedback.

Adequate grounding is the most important wiring precaution in this construction. As with all high frequency circuits, use a ground plane and good grounding techniques. At higher frequencies, device capacitances between IC terminals reduce voltage gain in the preamplifier due to decreased capacitive reactance from an increase in frequency.

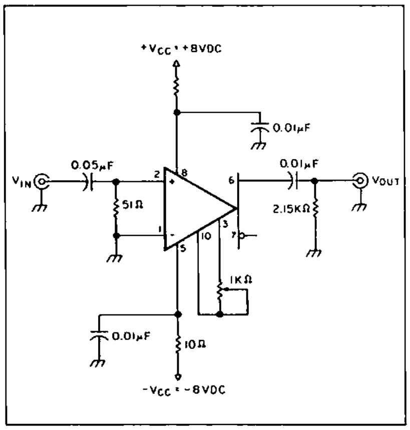


Figure 2. Schematic diagram of the oscilloscope preamplifier using an SK9017 integrated circuit. (Note that the IC pins are numbered differently for the Texas Instrument's NE592.)

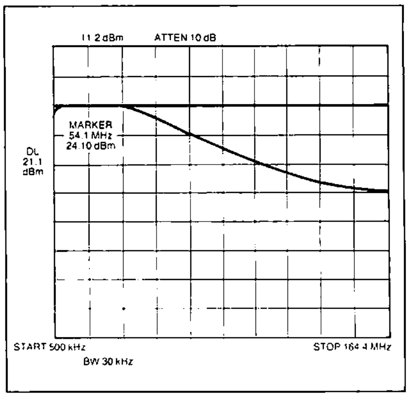


Figure 3. Swept frequency response of the oscilloscope preamplifier. (Note: the marker was set at the half power point, or −3 dB.)

While device capacitance between terminals affects the overall amplifier gain, the capacitance that exists between input and output terminals has the greatest effect. This condition is known as the "Miller Effect," and results in the effective capacitance being magnified by the voltage gain of the amplifier.

In summary, the ground plane should connect all unused areas of the pattern side of the printed circuit board. The ground plane then provides a low resistance, low inductance common return path for all signal and power returns, and reduces stray signal pick up.

Other Considerations

This circuit uses positive and negative DC voltages. To keep the supply voltage free of ripple and noise, bypass each power supply lead to ground. Solder the bypass capacitor as near as possible to integrated circuit pins. A 0.1 μF capacitor normally suffices. However, in high frequency and/or high gain circuits, a parallel combination of a 1.0 μF and 470 pF performs a suitable bypass.

The circuit easily mounted on a 4 cm x 5 cm perforated board that had a sufficiently large ground plane. I used no enclosure for this circuit. There are no IC sockets, and all components soldered directly to the "perf" board.

Single-point grounding is recommended in cases where point-to-point connections are used, or where a ground plane is not used. The input signal common, the load signal common, and the power supply common should be connected to the same physical point. This eliminates ground loops or common current paths which may cause signal modulation, distortion, or unwanted feedback.

Preamp Performance

I tested the oscilloscope preamplifier with a sweep generator and spectrum analyzer over a frequency range of 0.5 MHz to 164.4 MHz. Figure 3 shows the results.

As designed, the oscilloscope preamplifier provided a voltage gain of approximately 10 (±0.1 dB) from 0.5 MHz to 50 MHz. It actually only rolled off −3 dB at 54.10 MHz, and so exceeded specifications as shown in Figure 3. 73

Number 17 on your Feedback card

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Ionospheric Propagation

Although there will be some good days, the month of August is NOT expected to provide exceptional HF propagation. The worst conditions happen sometime between the 12th or 13th and the 16th or 17th. On these days the magnetic field may be unsettled to active (A=10 to 30) and the possibility of a solar flare is likely. In this period the 14th, 15th, and 16th are likely to be the poorest days. The rest of the month is expected to exhibit Fair to Good conditions for propagation. The fall equinox, which will occur in September, continues to increase solar flux values and the usually good DX conditions surrounding.

For those interested in astronomical events, there will be a partial eclipse of the moon for North America. It can be seen best in the western part of the United States, on August 27th. Propagation conditions will not be affected in any way by the eclipse. Keep checking the daily chart for F=Fair; P=Poor; and G=Good propagation. Trends are shown by Double letters F–G, for example.

Permanent records of sunspot activity begin in 1611, only one year after Galileo invented the telescope. Until recently, observers didn't begin to unravel the secrets of the causes of sunspots. Galileo noted that the spots appeared close to the sun's surface, and that they seemed to rotate with the sun. He noted that the sun itself rotated on its axis once every 27 days or so (the lunar month).

AUGUST

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G	2 G	3 G-F	4 F	5 F	6 F
7 F-G	8 F-G	9 F-G	10 G	11 G-F	12 F-P	13 P
14 P	15 P	16 P	17 P-F	18 F	19 F	20 F
21 F-G	22 G	23 G	24 G	25 G-E	26 F	27 F
28 F-G	29 G-F	30 F	31 F-G			

F—Fair G—Good P—Poor

In the mid-1700s, after a 100 years or so of accumulated data, observers first noted the more or less regular pattern, with sunspot numbers increasing, decreasing, and disappearing, over approximately 11-year periods. Cycle periods so far have ranged between 9–12 years, the average being 11.2 yrs. No two sunspot cycles are exactly alike.

In 1908, special photographs of the sun, taken by Dr. Hale of California's Mt. Wilson observatory showed that large sunspots are surrounded by whirling masses of luminous gas. Six years later, Dr. Hale discovered that sunspots are the centers of extremely powerful magnetic fields. Scientists have since developed detailed theories about the origin and behavior of sunspots.

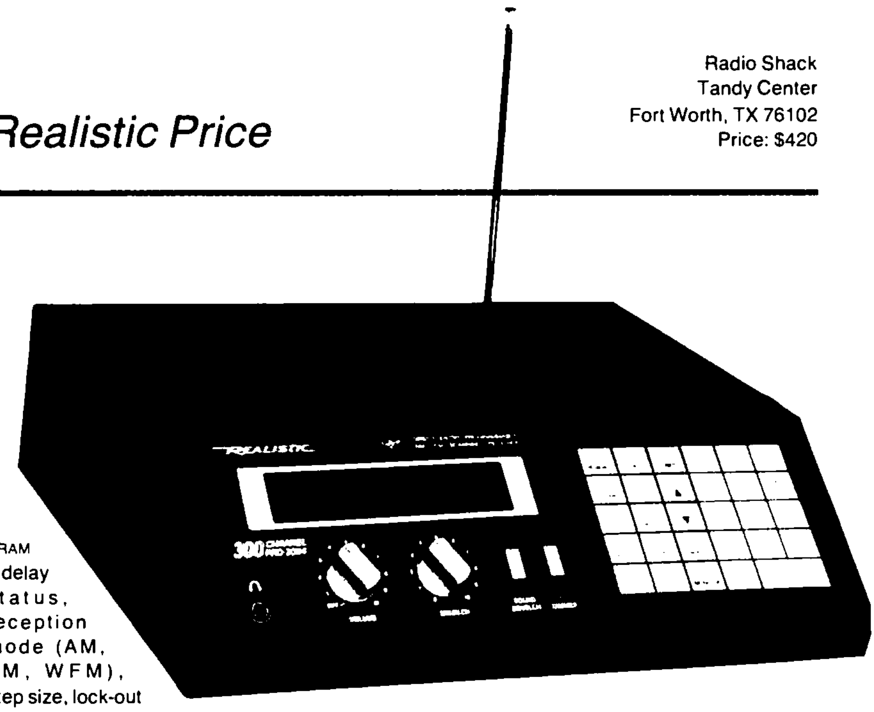
Some sources are predicting that Cycle 22 may well be the most active cycle ever. They expect peaking early, perhaps as early as 1989 or 1990, with extremely high solar flux values and frequent large solar/terrestrial disturbances. Cycle 22 will be a DXer's Delight.

73 Review *reviewed by Larry Ledlow, Jr. NA5E*

Radio Shack PRO-2004 Scanner

Top Performance at a Realistic Price

Radio Shack
Tandy Center
Fort Worth, TX 76102
Price: $420



The PRO-2004 scanner brings new life to reception of VHF and UHF signals. Radio Shack's latest entry in the wide coverage receiver market will knock the socks off just about any scanner enthusiast. This receiver boasts an abundance of features listeners only dreamed about a few years ago. Anyone who needs or wants serious scanning power between 25 and 1300 MHz should take a long, hard look at the PRO-2004.

The receiver is truly wideband, covering 25–520, 760–823.945, 851–868.945, and 896–1300 MHz. Note the conspicuous absence of the 800 MHz cellular telephone band. This coverage is easily restored with a simple modification (see the sidebar). The PRO-2004 features AM, narrowband FM (NFM), and wideband FM (WFM) demodulation, which are user-selectable on any frequency. The receiver also has the smarts to automatically select reception mode according to frequency.

With 300 memories in ten banks, listeners can customize their scanning by selecting any or all banks for reception. (Note that a simple modification will increase the memory to 400 channels!) Users can also lock out specific channels. To aid in searching such a broad frequency range, the receiver will memorize up to ten search ranges. Also, it will search in 5, 12.5 and 50 kHz steps at either eight or 16 steps per second (up to 20 steps or channels per second with modification). Now *that's* versatility.

A Closer Look

The PRO-2004 measures 2-⅞ × 10-¼ × 9 inches and weighs 7 pounds. Its front panel features 29 color-coded function and programming keys, volume and squelch knobs, dimmer and "sound squelch" buttons, a miniature headphone jack, and a multifunction green liquid crystal display. The LCD shows channel number, frequency, operation mode (SCAN, MANUAL, SEARCH PRIORITY, PROGRAM), delay status, reception mode (AM, FM, WFM), step size, lock-out status, monitor channel/memory bank number, battery condition, and error status. The rear panel features external speaker and recording jacks, an input jack for 13.8VDC, memory backup battery compartment access panel, a sensible BNC antenna connector, a 10 dB attenuator switch, the AC power cord, and the CPU reset switch.

> ***"Of course, a simple touch of the SCAN button initiates scanning across all 300 memories."***

The 24-page operating manual is fairly complete with detailed function descriptions and operating instructions. It also lists a number of frequency ranges of interest, listening pointers, and troubleshooting tips. A schematic would have been nice. The block diagram printed in the manual is relatively uninformative, since it lacks information about the three intermediate frequencies, the sound squelch circuit (more on that below), and a few other items of interest. The manual does, however, recommend contacting Radio Shack's National Parts Department for the most accurate schematic and parts lists.

Getting started is straightforward. Programming a frequency into a memory requires only three steps: channel selection, PROGRAM mode selection, and frequency entry from the keypad. The scanner will accept any frequency within the bands listed above, but it will round off frequency values to the nearest 5 or 12.5 kHz depending on the band. For example, 101.143 MHz entered from the keypad will become 101.140 MHz in the memory.

Of course, a simple touch of the SCAN button initiates scanning across all 300 memories. Users can select the two second delay feature to cause the receiver to resume scanning two seconds after a transmission ceases. This is often adequate to catch both sides of a conversation, but I would prefer an adjustable

delay time, perhaps up to five or more seconds. Without the delay selected, scanning will resume as soon as the received signal drops. Listeners can force scanning to resume by hitting the SCAN button again.

The user can lock out unwanted channels by selecting them manually and hitting LOCK OUT. The LOCK OUT REVIEW button will display all locked out channels for easy review. Entire memory banks can be locked out by pressing the appropriate numbers in the scan mode. The receiver only allows one priority channel, but any of the 300 memories can serve as the priority channel. In scan or manual modes, this function will check the priority channel for activity every two seconds.

I strongly advise buyers to read the manual first and follow its step-by-step instructions. Listeners experienced with only Uniden or Regency scanners will find a number of mysterious functions on the PRO-2004 keyboard. They must also understand the importance and uses of the memory banks to best use the scanner's features.

Harnessing the Features

With such a wide frequency coverage, the PRO-2004 would be almost useless without its sophisticated search functions. An eleventh bank of ten memories serves as a temporary storage location during frequency searches. Further, the scanner will retain up to ten different search ranges, a handy feature that allows the listener to search for specific services with- out constantly reprogramming search limits.

> *"Best of all it's affordable!"*

Suppose an operator wants to scan the two meter and 70 centimeter bands for repeater activity. He first selects the program mode, chooses the first search range with 1 LIMIT, enters 145 MHz (lower limit #1), hits the LIMIT key again, and enters 148 MHz (upper limit #1). He then chooses the second search range in a similar manner and enters 440 and 450 MHz upper and lower limits. These search ranges are retained, and the listener can select either one with two key strokes.

The DIRECT button will begin a search in a selected direction and without specific limits. Up or down arrows initiate search in their respective directions for both limit and direct modes.

When the listener hears a signal of interest, he can hit the MONITOR button to store it in one of ten temporary memories. These temporary memories are highlighted at the top of the LCD, and the selected one blinks on and off. To move a frequency from temporary to permanent storage, the user needs only to execute as few as three key strokes.

Smart Squelch

The PRO-2004 has two squelches. One operates in a normal fashion, but the "sound squelch" feature is special. When the scanner stops at a frequency during scan, search or priority modes, the sound squelch checks for audio modulating the carrier. If the carrier is truly dead (unmodulated), then scanning will resume 0.5 seconds later with the sound squelch turned on. Noisy signals or those with low-level modulation may not be received properly with the sound squelch turned on. I did not find this feature very useful, but listeners in RF-congested areas may discover the sound squelch is essential.

The top-mounted, three-inch speaker provides plenty of audio for most environments, including my truck bouncing down some of the roughest mountain roads in this part of New Hampshire. Though obviously not designed as a mobile scanner, since it lacks a mounting bracket or holes to accommodate one, it worked quite satisfactorily sitting on the truck's floor or passenger seat. Speaking of audio, the tape output provides approximately 600mV into 10kΩ, which will easily drive most properly functioning recorders.

Tops!

In short, I'm impressed. After more than three months in nearly round-the-clock use, my PRO-2004 scanner performed flawlessly. I hardly missed a cosmonaut's comments or a volunteer fire call. I've been a scanner buff for more than a decade, and the 2004 gave me almost everything I could want in a VHF receiver. I would have liked a signal strength meter, automatic frequency entry into memories during search, perhaps a video demodulator option, and even computer control facilities, but this little radio has a heck of a lot going for it. Best of all, it's affordable!

Radio Shack gives us listeners something to cheer about—the PRO-2004! 73

Number 38 on your Feedback card

The Hidden Secrets of the PRO-2004

by Michael J. Senff KB6LCN

The PRO-2004 scanner was made to scan 25 MHz to 520 MHz and 760 MHz to 1300 MHz. The receiver had been modified so that it would not scan parts of the 800 MHz band. These frequencies are the cellular phone frequencies. When trying to program in a 800 MHz frequency, the unit will give an error message on the diplay.

After programming in all of the cellular, police, and air navigation frequencies, I found that I only had 90 channels left. I ordered the service manual and modified the unit to 400 channels.

The tools needed to modify the unit are: soldering gun (25-40 watts), solder and a phillips screw driver. A cloth or newspaper should be placed on the work area.

The unit should be unplugged from the wall outlet. Remove the four screws on the back of the scanner and slide the casing off. Turn the unit upside down so that the faceplate is closest to the constructor. Locate PC-3. This is the central processing unit or CPU printed circuit board. Remove the five connectors labeled cn 501, cn 502, cn 503, cn 504, and cn 505. Remove the seven screws on the edge of the circuit board and remove the board from the scanner. Turn the board over. Note the location of diodes D-502–D-515. D-513 *may* be on the underside of the board. There should be a diode close to the edge of the circuit board about one inch away. Remove diode 513-(D513). This enables the scanner to scan all of the 800 MHz band!!!

Take the removed diode and solder it to the position for D-510. This tells the CPU's ROM to access more memory in order to have 400 channels. A diode installed at D-514 will increase the scan rate to 20 ch/sec. Reassemble the scanner in reverse order. Make sure that all connections are made.

I hope these modifications were enjoyable. Remember that what is heard cannot be repeated to anyone or used for personal gain. It is for enjoyment only.

Diode Functions

d-510 In circuit, scanner will have 400 memories.

d-512 In circuit, it will step 30 kHz from 825-844.995 and 870-889.995 MHz.

d-512 Removed, it will step 12.5 kHz from 825-844.995 and 870-889.995 MHz.

d-513 In circuit, it will not scan 825.844.995 MHz or 870-889.995 MHz.

d-513 Out of circuit, it will scan all of the 800 MHz band.

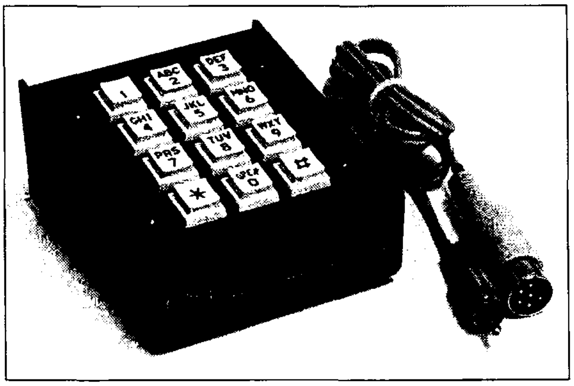
d-514 In circuit, scanning rate increases to 20 channels per second.

(Ed note: These modifications are made at your own risk.)

Number 19 on your Feedback card

NEW PRODUCTS

Compiled by Linda Reneau

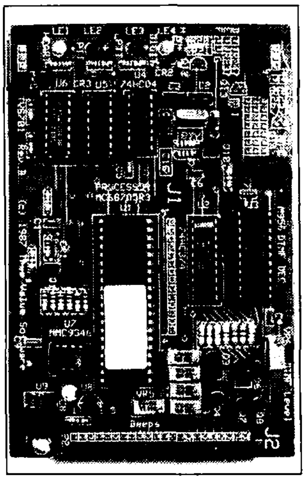


PRODUCT OF THE MONTH

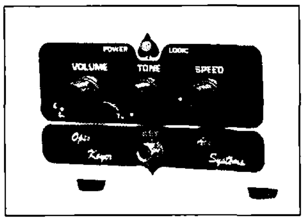
STONE MOUNTAIN ENGINEERING

Stone Mountain's KW-QSYer for Kenwood rigs provides high speed keying and easy frequency selection. Its full-size keypad is inclined at a ten degree angle for comfort as well as speed. Popular with contesters and blind operators. The QSYer is a tiny computer terminal in an all-metal housing, measuring 3.1 x 3.5 x 2 inches. It has an internal speaker that sounds a different tone for each key. The KW-QSYer works with the TS-940 series (with the Kenwood IF-10B interface), the TS-440 series (with the IC-10 interface), the TS-140 series (with the IF-10C interface), the TS-711/811 series (with the IF-10A interface), and requires an 8–16 V, 100 mA, external DC supply. The sister models are available for the 757GX, 757GX-II, 767GX, and the IC-735. Priced at $89.50 plus $2.50 shipping. A companion 12-volt DC wall supply for the KW-QSYer is $10. For more information contact *Stone Mountain Engineering Company, Box 1573, Stone Mountain GA 30086; 404-879-0241*. Or circle Reader Service number 201.

TRUE VALUE SOFTWARE

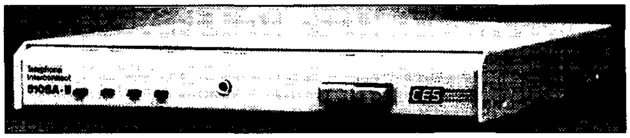


The True Value Software TVS701B repeater controller can be remotely configured without ROMS or jumpers. The unit offers voltage telemetry and alarms to monitor batteries and power levels. A watchdog timer and EEPROM protect the unit from power failure. TVS701B has 74 functions, four levels of control security, digital inputs and outputs for auxiliary control, and alarms. **Assembled and tested: $190.** For more information contact *True Value Software, 2805 E. Sherran Lane, Phoenix AZ 85016; 602-956-4259.* Or circle Reader Service number 202.



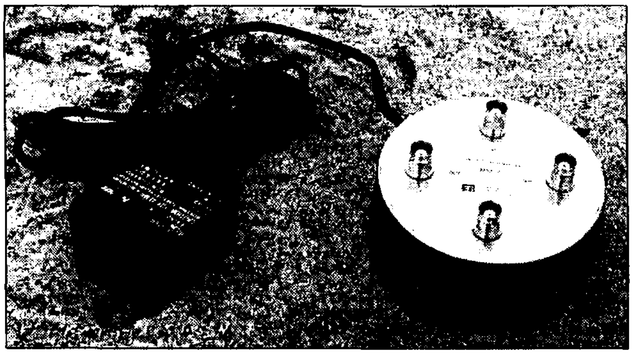
ACE SYSTEMS

Ace Systems offers the battery-operated Opto Keyer with a built-in speaker, isolated output with no mechanical T/R switching, reverse polarity protection, self-completing dots and dashes, LED status indicator for keying and battery. Price is $39.99 plus $3 shipping. All products are guaranteed for one year. Call or write for more information to *Ace Systems, RD 1 Box 83, Wilcox PA 15870; 814-965-5937.* Or circle Reader Service number 203.



COMMUNICATIONS ELECTRONICS SPECIALISTS, INC.

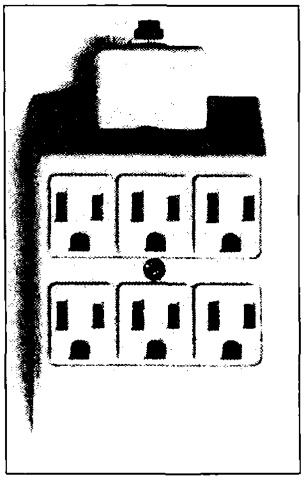
CES has a new model 510SA-II telephone autopatch for fixed station and repeater applications. The 510SA-II has multi-digit DTMF connect code, activity timers, CW ID, toll restrict, and disconnect override code programmable with any DTMF telephone with security code access. Also, it has remote operation by security code, repeater logic control, reverse patch capability with automatic ringout on inbound calls. Accessories are also available. The list price is $583.33. Contact *CES, 931 S. Semoran Blvd., Suite 218, Winter Park FL 32792.* For more information circle Reader Service number 209.



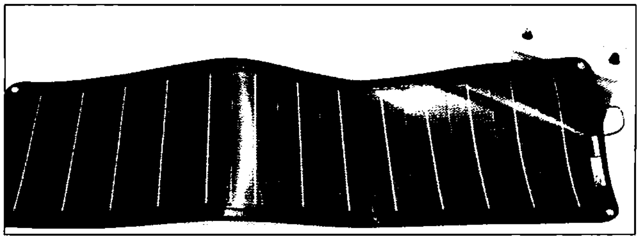
ELECTRONIC PROCESSING, INC.

The MRA-3 Multiple Receiver Adapter from Electronic Processing, provides SWL listeners and scanner owners with a way of connecting more than one receiver to an antenna. Using BNC jacks, the MRA-3 will connect up to three receivers to one antenna. With an internal amplification stage, the MRA-3 assures equal or better signal strengths than with the antenna connected to only one receiver. The MRA-3 is powered by 115 VAC at less than 5 watts. 12 volt DC models are also available on special order. Pricing starts at $69.95 and quantity discounts are available. Order from *Electronic Processing, Inc., Sales Department, PO Box 708, Medford NY 11763; 516-764-9798.* Or circle Reader Service number 210 for more information.

SPI-RO MANUFACTURING, INC.



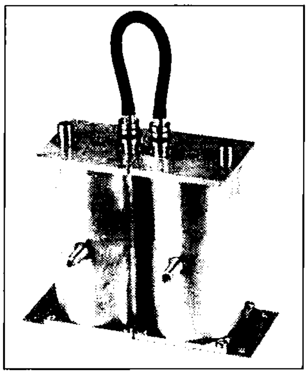
Spi-Ro Manufacturing's SP-6-CB surge protector, rated at 15 amps, 125 V, 60 Hz, is equipped with an EMI/RFI filter and UL-listed surge suppressor. It has 6 outlets and a resettable circuit breaker. Protects electronic equipment from voltage surges and spikes on the incoming power line. The maximum spike current is 4,500 amps. Priced at $29.95. Contact *Spi-Ro Manufacturing, Inc., PO Box 1538, Dept. S, Hendersonville NC 28793.* For more information circle Reader Service number 204.



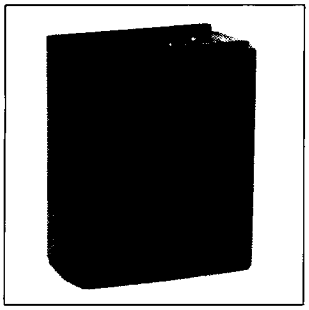
HAL-TRONIX and ANTENNAS WEST

SunFlex, a lightweight, durable, and flexible Sovonics solar battery charger, is available from Hal-Tronix. SunFlex is equipped with blocking diodes to prevent discharge of the battery at night or on cloudy days. MA-2, the most compact generator, can be plugged into a cigarette lighter. MA-3 maintains boat or RV batteries. The MA-5 can power portable radios. MA-10 gives standby power for deep discharge batteries. MA-20 is useful for versatile mounting applications, and MA-30 may be used for single applications or arraying. The price range for these product is $80 to $475. Contact *Hal-Tronix, 12671 Dix-Toledo Hwy., Southgate MI 48195. Antennas West address is 1971 N. Oak Lane 1300 E., Provo UT 84604; 801-374-1084.* Circle Reader Service number 208 for more information.

MICROWAVE FILTER COMPANY, INC.

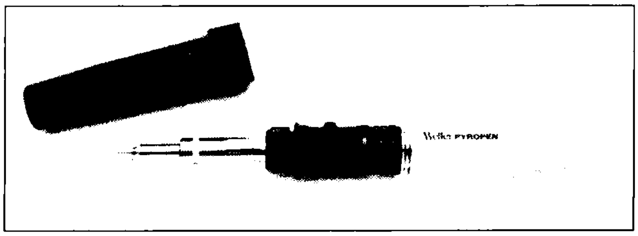


Microwave Filter Company has a series of 6556 notch filters. Installed in the filters is a block band to eliminate strong terrestrial interference and to clear a dedicated service channel. These filters are pretuned, but are adjustable in frequency and bandwidth. Model S6556 is a single notch filter. While Model D6556 has two notches with 10 MHz below and above channel center. Notch loss is 16 dB minimum at the factory set bandwidth of 3 MHz. The units may be retuned +/− 25 MHz minimum. They have type F connectors and an impedance of 75Ω. The price of the S6556 is $139, and the D6556 is $249. Contact Linda DeCoursey for a copy of Bulletin 09, which describes this series of filters. For technical information, contact *Steve Shafer, Microwave Filter Company, Inc., 6743 Kinne St., East Syracuse NY 13057; 800-448-1666 or call collect 315-437-3953 for New York, Hawaii, Alaska, and Canadian residents.* For more information circle Reader Service number 212.



PERIPHEX, INC.

Periphex has a new battery pack for the Kenwood TR-2500/3500 and the TR-2600A/3600A. The PB-25S/26S, 8.4 V/900 mA battery pack has double the capacity of the original PB-25 or -26 packs. It is compatible with the Kenwood ST-2 base charger, MS-1 mobile charger, and the trickle wall charger. The PB-25S/26S includes overcharge, over temperature, and short circuit protection. Priced at $65 plus $3 shipping. Contact *Periphex, Inc., 149 Palmer Road, Southbury CT 06488; 800-634-8132. In CT, 203-264-3985.* For more information circle Reader Service number 206.

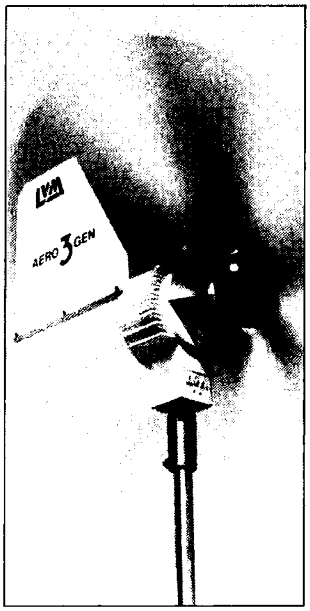


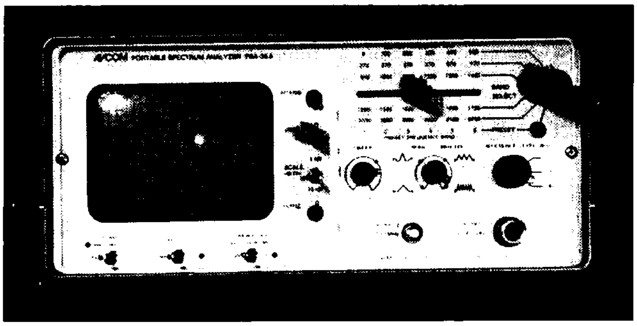
CooperTools™

The Weller® Pyropen from CooperTools™ may be used as a soldering iron or hot air gun. With push-button ignition, it's useful for single-handed and field operation. The 4.4-ounce cordless Pyropen has about three hours burning time before it needs refilling. The price is $76.40 and it is available from *CooperTools™, PO Box 728, Apex NC 27502.* For more information circle Reader Service number 205.

BRADLEY & ASSOCIATES MARKETING

Available from Bradley & Associates is the 13 ½lb LVM-3 Wind Generator, made by L.V. Motors, for charging 12/24 V lead acid batteries. It incorporates a 12-pole, 3-phase permanent magnet alternator, 30-inch diameter fan, an aluminum tail fin, and requires no special installation. The LVM-3 generates high output at moderate wind speeds. It is thermally protected from overloading during periods of constant high winds. An optional shunt regulator to prevent battery overcharge at an unattended installation is also available. The suggested retail price is $1,098. *LVM/Bradley & Associates Marketing, 5147 South Harvard, Suite 123, Tulsa OK 74135.* Circle Reader Service number 207 for more information.





AVCOM

Avcom introduces the PSA-35A Portable Spectrum Analyzer with a standard center frequency band, calibrated from 1250 to 1750 MHz to cover European BDC frequencies. Also included is a switch selectable 2 dB/division or 10 dB/division sensitivity function. Avcom's PSA-35A also covers 10 to 1750 MHz and 3.7 to 4.2 GHz, a built-in DC block with +18 VDC for powering LNAs and LNBs, signal amplitude display, and rechargeable battery with charger. Priced at $1,965. For more information contact *AVCOM of Virginia Incorporated, 500 Southlake Blvd., Richmond VA 23236; 804-794-2500.* Or circle Reader Service number 211.

CAT TO RS-232 INTERFACE

Simple computer control for Yaesu Equipment

by Mike Roberts N9CLX

With the advent of today's modern radios comes the convenience of memory channels. Some rigs have a few and others have hundreds. This is a very nice feature, but how can anyone remember all those frequencies without a list?

Why not let the computer do the work? After all, the machine has a way with numbers. This project allows the user to interface a Yaesu radio with a PC. I have tried using an IBM PC with a shareware program called the Yaesu FT-757 GXII CAT Program, written by Dick Roux N1AED.

With this program the user can read the status of most front panel controls (including S-units) or change them from the keyboard. Also featured is a station directory in which the user can store names, frequencies, and modes on disk. Then, by punching a couple of keys, the station directory is loaded into the radio.

This program is available on several bulletin board systems. Dick's latest version (2.0) is no longer available as shareware. This latter version is very smooth running and allows 480 entries in the station directory. It will run on a color or monochrome system. More information on this program may be obtained from Dick for an SASE.

One-Evening Project

If using a Yaesu rig with the CAT system feature, and an IBM or compatible PC, the only additional component needed is a logic interface. Basically, this circuit converts the +5 volt logic levels in the transceiver to the RS-232 standard for connection to a serial port. The idea of controlling a transceiver from a computer is not new; after all, Yaesu sells an interface for under $100. They do not however, as of this writing, have a program for the IBM and compatibles. This project is a very low cost alternative to the commercial device. I assembled this project in one evening, although it was a late one! All parts except the mini-DIN connector are available at Radio Shack.

Circuit

This is a fairly simple project consisting of only two CMOS devices, the MC1488 transmitter chip, and its companion the MC1489 receiver. Data from the computer is taken from pin 2 (transmit) on the serial port and is routed to pin 1 of U1. U1 changes the signal level from plus and minus 10 volts to 5 volts on its pin 3, which connects to pin 3 (serial input) on the CAT jack. C1 is included to prevent false triggering on transient waveforms.

The other half of this circuit functions similarly, but in reverse. Data from pin 2 on the CAT jack (serial out) goes to pin 2 on U2. U2 changes 5 volt signals to plus and minus 10 volts on pin 3, and this connects to pin 3 (receive) on the computer's serial port. R1 is a pull down resistor on the input of the transmitter chip. It keeps the voltage on pin 2 below two volts when the data link is idle. Jumpers between pins 4-5, and 6-20 on the DB-25 connector are necessary to provide the computer's serial port with the proper handshaking signals for an online state.

Construction

Since there are only a few connections to make, I assembled this circuit on a Radio Shack dual IC board (see parts list). Just keep track of the pin numbers and solder the wires to the pads around the edges of the board. The layout is not critical, but to avoid loops, tie all signal grounds together at one point with the power supply common lead.

Sockets can be used for the IC chips for easy replacement in case of trouble in the future. The user can also use sockets for the data connectors, but since it's much easier to just drill a hole, I opted to solder the leads directly to the circuit board. First install all the components on the board and wire in jumpers where necessary. Then pass the cables through the holes drilled in the cabinet and solder the free ends to the board.

A bipolar power supply is required for this circuit. I have included a sample diagram of a typical supply of this type. The power transformer is a small plug in type. Output voltage should be somewhere between 14–18 VAC at

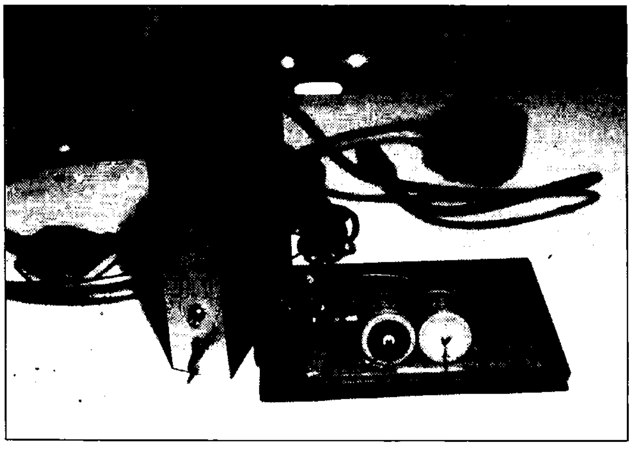


Photo A. Inside the CAT to RS-232 Interface.

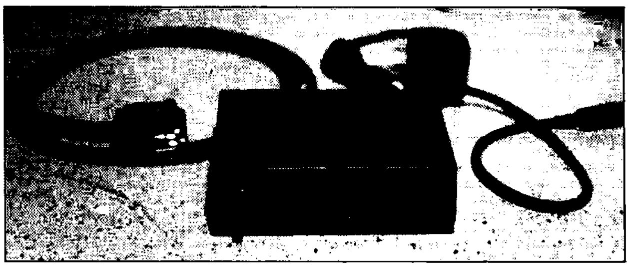


Photo B. The completed interface.

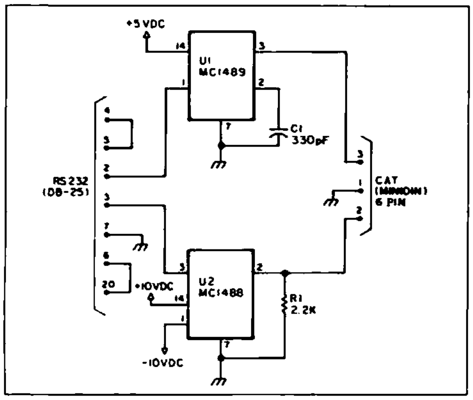


Figure 1. The circuit schematic.

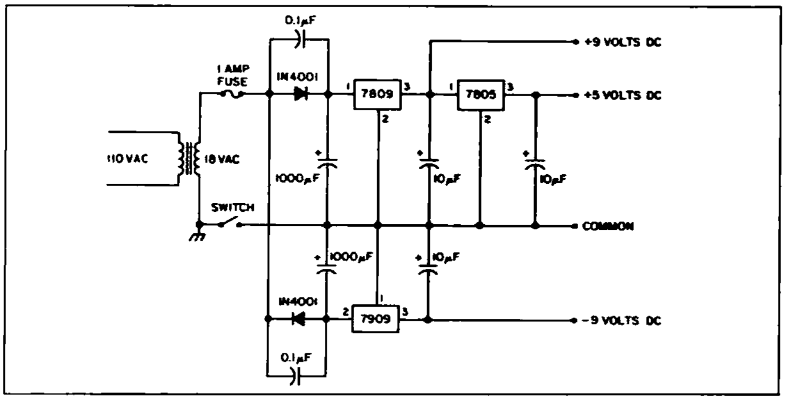


Figure 2. Typical power supply.

50 mA or better. For regulation, 78XX and 79XX series three terminal devices can be used. These can be 9 or 12 volt chips for the driver, and 5 volts for the receiver chip. The RS-232 port is not too fussy. It will work from plus and minus 7-15 volts. U2, however, requires five volts, which is its maximum source voltage. Supplies of this type are well documented in past *73* issues and ARRL handbooks.

Use twisted pair shielded cables for the signal lines. This will keep out stray RF and magnetic fields emanating from within the shack. Since the rigs and serial ports have RFI suppression built in, I did not use any additional measures. If RFI is a problem, try putting some ferrite beads on the cables.

The CAT jack on the transceiver is a six-pin mini-DIN type. If the user has an 8-pin type, it can be modified by carefully pulling out the two center pins from the back of the plug with needle nose pliers. The DB-25 connector is usually a female type, but don't tempt Murphy, eyeball the port first. Jumper the pins as shown in the diagram. This allows the port to operate in full-duplex mode without any additional control signals.

```
                        *** STATIONS DIRECTORY ***

  1  - AFRTS (15mhz)                       21  - CBC Canada (6mhz)
  2  - V. OF FREE CHINA (15mhz)            22  - Vatican Radio (6mhz)
  3  - AFRTS (6mhz)                        23  - KNLS- Alaska (6mhz)
  4  - HCJB - ECUADOR (6mhz)               24  - Radio Yugoslavia (7mhz)
  5  - R. NETHERLANDS (6mhz)               25  - Radio Kiev (9mhz)
  6  - VOICE OF TURKEY 9mhz                26  - Radio Mongolia (12mhz)
  7  - R. JAPAN (9mhz)                     27  - Radio Denmark (15mhz)
  8  - R. CAIRO (9mhz)                     28  - Radio San Gabriel (15mhz)
  9  - BRT - BELGIUM (6mhz)                29  - Radio Moscow (7mhz)
  10  - WWV (15mhz)                        30  - Voice of Greece (9mhz)
  11  - BBC-LONDON (9mhz)                  31  -
  12  - CFVP-CALGARY(6mhz)                 32  -
  13  - France International(9mhz          33  -
  14  - VRNO Worldwide(6mhz)               34  -
  15  - Radio Australia (15mhz)            35  -
  16  - Radio Moscow (5mhz)                36  -
  17  - Radio Moscow (9mhz)                37  -
  18  - Voice of America (6mhz)            38  -
  19  - Voice of America (9mhz)            39  -
  20  - US Armed Forces(6mhz)              40  - WLUP (chicago) 1mhz
ENTER SELECTION, <E>DIT, <Q>UIT, <L>OAD OR <ENTER> FOR NEXT PAGE?
```

```
                   *** TRANSCEIVER STATUS DISPLAY ***

SCAN MODE = OFF                          DIAL UNLOCKED
BAND = 4.0 --> 7.5 MHZ                   SPLIT OFF
SELECTED MEMORY = 6                      CLARIFIER OFF
                                         'A' VFO ACTIVE
OPERATING FREQ = 7354 KHZ                VFO OPERATION
SELECTED MODE =AM                        RECEIVE
                                         HAM BAND MODE
VFO A FREQ = 7354 KHZ
VFO A MODE =AM                           SIGNAL STRENGTH = S9

VFO B FREQ = 9979.55 KHZ
VFO B MODE =USB

CLARIFIER FREQ = 14259.87 KHZ
CLARIFIER MODE =USB

MEM #0 FREQ = 15000 KHZ ---> AM          MEM #5 FREQ = 5000.03 KHZ ---> AM
MEM #1 FREQ = 7062.95 KHZ ---> LSB       MEM #6 FREQ = 10000.09 KHZ ---> AM
MEM #2 FREQ = 29433.59 KHZ ---> USB      MEM #7 FREQ = 6230 KHZ ---> AM
MEM #3 FREQ = 21233.51 KHZ ---> USB      MEM #8 FREQ = 6020 KHZ ---> AM
MEM #4 FREQ = 29407.09 KHZ ---> USB      MEM #9 FREQ = 9600.03 KHZ ---> AM
   HIT <ENTER> TO RETURN TO MAIN MENU
```

```
          --- YAESU FT-757GX MK II CAT PROGRAM ---

                  1 - STATUS DISPLAY
                  2 - CONFIGURATION DISPLAY
                  3 - STATIONS DIRECTORY
                  4 - EXIT TO DOS

               SELECTION?
```

Operation

Now for the easy part, the adjustments. There are no pots or anything to tune. First verify that the mini-DIN plug has no more than 5 volts on any of its pins. Next comes the DB-25, which should have no more than plus or minus 15 volts on pins 2 or 3. Now plug in the connectors and power everything up.

The CAT program I mentioned earlier is configured to use COM 1, so make sure that the interface is plugged into COM 1. After starting up the program and answering the questions, the user should be at the main menu. From there just follow the prompts, and have fun!

If for some reason a problem occurs, a digital voltmeter can be used to see if data transitions are occurring on the line. Try sending a command from the keyboard while monitoring pin 2 on the DB-25. If the user gets a quick voltage swing, all is well so far. Now move to pin 3 on the mini-DIN connector and try again. Troubleshoot the U2 side of the circuit in the same manner. Problems caused by U1 will show up as inability to access the transceiver. Inability to get a status display would point to a bad U2, if the configuration portion works.

Use Your Imagination

For those fluent in programming language, there are many possibilities for this device. How about assembling a program to compensate for doppler shift during an OSCAR pass? Or maybe a small basic program that would tune in WWV at preset times, input the signal strength and store the data in a disk file. The user could then recall the data to compare notes on propagation prediction charts.

I have found the CAT-to-RS-232 interface to be a very handy device, used to enhance the operation of a modern transceiver. An excellent way to control all those bells and whistles. If the user has any problems or questions, I can be reached via the WA9UXP BBS/145.070 MHz, located in northern Indiana.

The CAT757 GX program is available from Dick Roux N1AED, 25 Greenfield Drive, Merrimack, NH 03054. ■

PARTS LIST

1. 2.2k resistor
2. MC1488 driver (276-2520)
3. MC1489 receiver (276-2521)
4. 330pF capacitor
5. Dual IC PC board (276-169)
6. DB-25 connector (female) (276-1548) & (276-1536)
7. 6 pin mini-DIN connector (cat. #N7372) Edlie Electronics
8. LED
9. SPST switch
10. Cable (twisted pair w/shield)
11. Cabinet (270-210)
12. Power Supply, +5VDC, ±15VDC (see text)

Solder Iron Auto Shut Off

A redeeming safety switch

Robert P. Krieger, Jr. KAØQHV

Hams who can begin a soldering project and run from start to finish uninterrupted are truly fortunate. This device was put together for the other 99% who must work our construction time around obstacles. Backyard dog and kid fights are common and usually go from "noisy" to "painful" quickly if not broken up. The wife's car requires constant maintenance, and friends with broken TVs, radios, CBs and other electronic goodies appear regularly to get in the way of a non-stop start-to-finish job.

Returning to the shop to find a solder iron tip burnt to a black flaky crisp, after being left on for two days, got old fast. It also happened often enough to initiate a search for a time controlled auto-shut-down circuit for the iron. Straight timing circuits are useful, but they usually wait until the wrong moment to automatically shut off without warning.

Helpful Reminder

This project will not solve all the problems around the shop, but it can help with the two previously mentioned. The heart of this device was published nearly 10 years ago as a circuit fragment.[1] It has worked well in many modified ways for a long time. Basically this circuit, when turned on, will time 15 minutes (approximately) then shut off. . .BUT. . .20 seconds before it shuts off, it will give a one second tone telling the user to reset the timer for another 15 minutes, if a hot iron is still needed.

In an attempt to maintain "quick and easy" project status, theory will be brief. Essentially we have: 1) a regulated power supply; 2) a logic and timing circuit; 3) an optically-isolated high voltage control circuit.

CMOS "NAND" gates are wired as one-shots, and a tone generator controlled by RC time constant, make up the heart of the logic circuit. Regulating the power supply will help to keep timing consistent and an optically isolated Triac handles the job of AC switch.

There are actually three RC timers here. R8 and C1 control the initial time on period (15 minutes). R6 and C3 determine how long the tone is produced (one second). R2 and C2 vary on how long the device stays on AFTER the tone (20 seconds).

The RC combinations are flexible and can be varied to the individual needs but bear in mind, an unattended soldering iron can start a fire in less than 15 minutes, so this project also has a redeeming safety value.

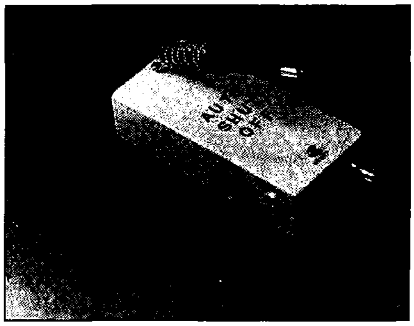


Photo A. Completed project with solder iron in holder. Fuse and LED mounted on end of the box.

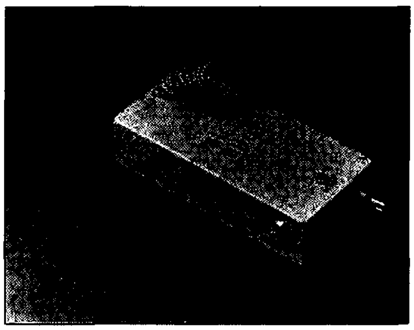


Photo B. Completed project showing line socket and switch on side, reset button and iron holder on top, fuse and LED (D-6) on end of box.

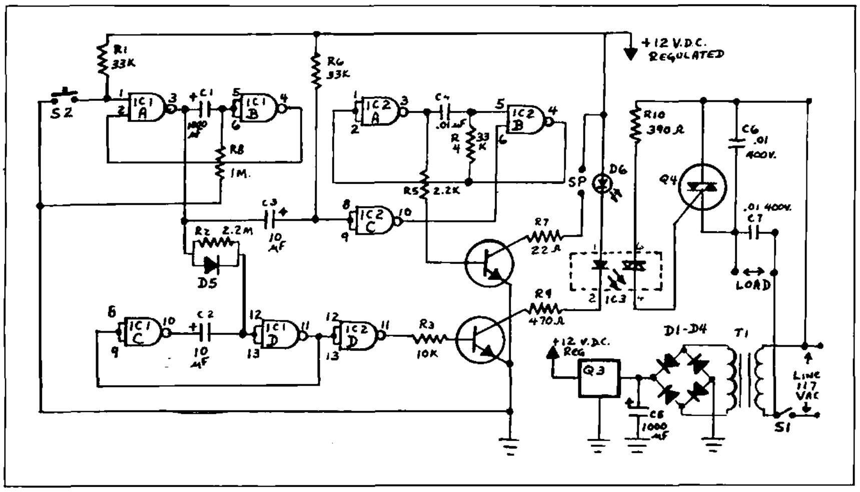


Figure 1.

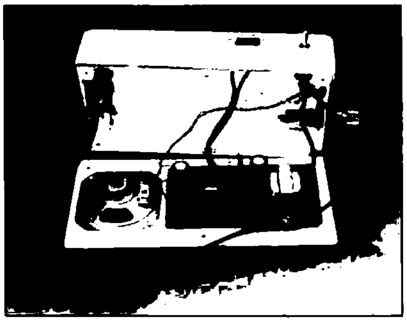


Photo C. Parts placement in plexiglass box. Note: series wired switch and fuse. Also D-6 mounted next to fuse using extension wires.

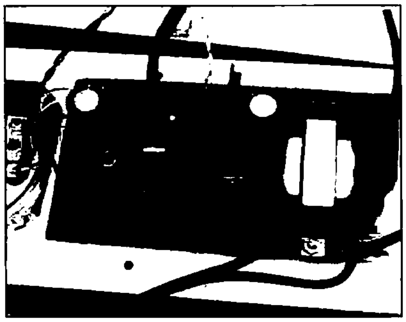


Photo D. Closeup of PC board. Note: Orientation of diodes D1-D4, also Q3, voltage regulator and IC chips.

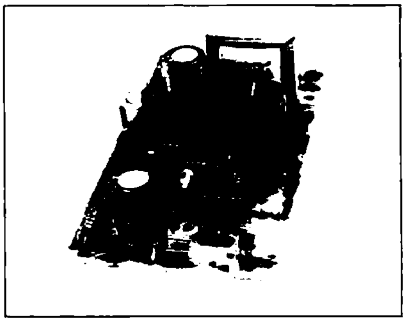


Photo E. 10k Ω resistor tack soldered piggyback to R8 in foreground. Note: Orientation of transformer, Q3, Q4, IC2 and IC3.

All parts, with the exception of the female 117 V line socket, are available at Radio Shack for about $30 total. Mail order shopping can cut the expense markedly and a well stocked junk boxes could yield virtually all the parts. The line socket is available at nearly any hardware store.

There is nothing exotic about the circuit, point-to-point wiring or a printed circuit board will work.

Using the PC board

Read the entire process, then place the transformer so the secondary faces the short end of the board. Solder each part when installed except when noted. Install diodes D1–D4 observing polarity. Install capacitor C5 (1000uF 25 V radial) voltage regulator Q3. The side with the numbers on voltage regulator (Q3) should face D1–D4. Temporarily solder a short piece (about 12 inches) of wire in the hole at point "C"-solder another short piece of wire (about 12 inches) in the point "B" hole. Connect a DC voltmeter to these points-"C" being positive. Solder test line cord in holes at "D" and "E."

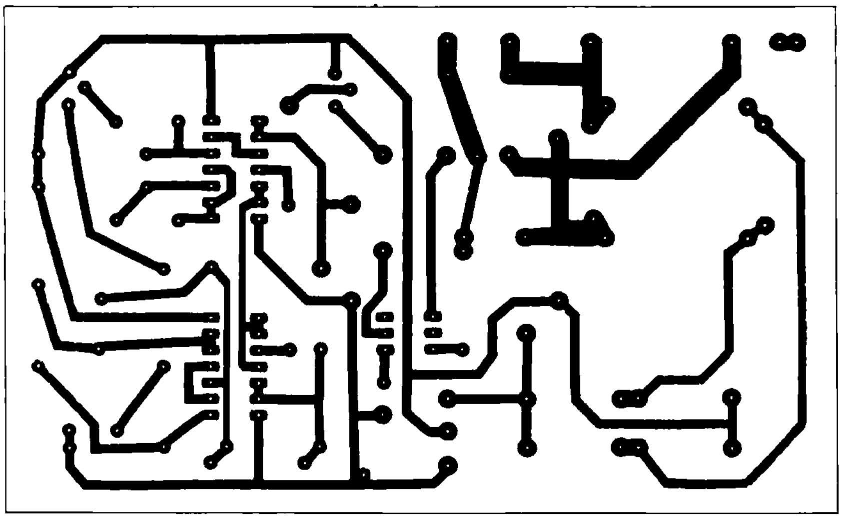


Figure 2.

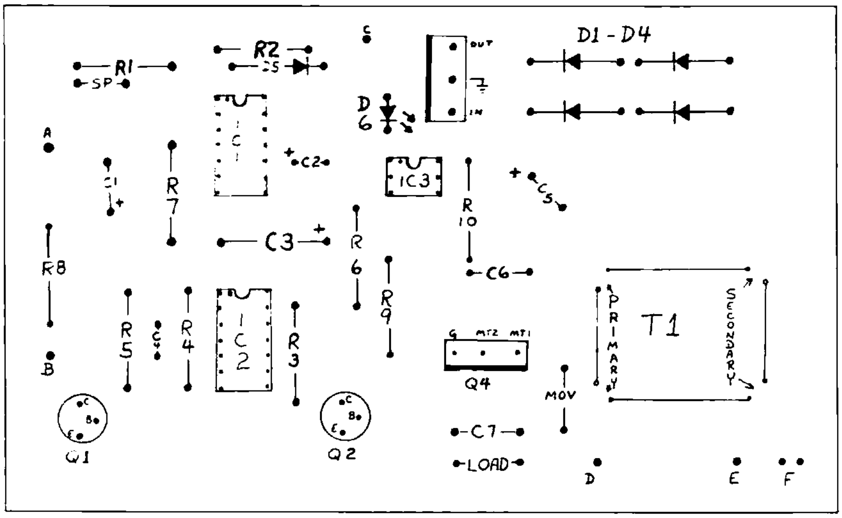


Figure 3.

A few words concerning test cords and safety is in order at this point. If constructed as in Figure 4, the test cord is useful for testing transformers and other temporary connections to line-operated devices (this project included). The user *must* put the fuse in the "hot" line, and use a polarized plug. If the fuse and polarized plug are left out, it creates what the old timers call a "suicide cord." The results may be a nasty shock and possible burns, or worse, "Permanent Ground Potential"(R.I.P.).

The next step utilizes 117 VAC line voltage. Use common sense and be careful. Time for the first smoke test. Plug in the line cord and observe the voltmeter. The transformer may rattle if not bolted down-this is normal. Proper indication is 12 volts DC plus or minus 5%. (11.4 to 12.6 VDC is acceptable.) Record the voltmeter reading. Any large variation from 12 VDC means trouble and should be corrected.

Upon confirmation of correct regulated voltage, proceed as follows. **Unplug line cord!** Solder in place IC sockets, R1 through R10, D5, D6, C1 through C4, (observe polarity on C1, D5 and D6) C6, C7, M.O.V., Q1, and Q2. **Do not install Q4 or put IC's in the sockets yet!**

Check for solder bridges on IC sockets, and solder splash anywhere else on the board. If all appears correct, once again plug in the line cord and observe the voltmeter (set up as before). Reading should be same as earlier recorded. Any variations again mean something is incorrect and should be checked before continuing. **Unplug line cord again!**

If all is well, solder two wires to points marked "SP" and connect to an 8Ω or more speaker. Solder a short wire to point "A", then connect wires from points "A"

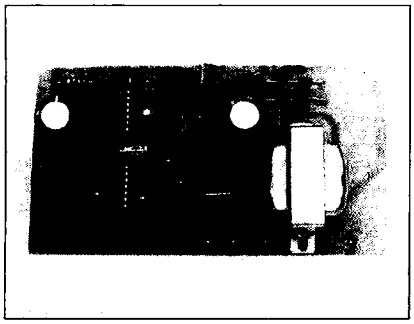


Photo F. Placement and orientation of diodes D1-D4, Q3, Q4, and IC chips 1, 2, and 3.

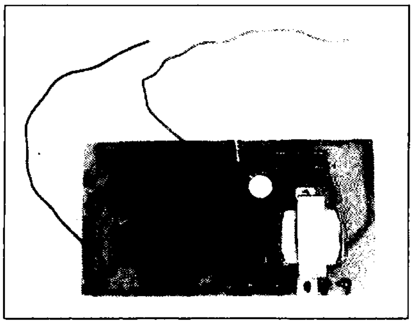


Photo G. Transformer in place as are diodes D1-D4, C5, M.O.V., and voltage regulator Q3, ready for first smoke test. (Black wire point B - red wire point C)

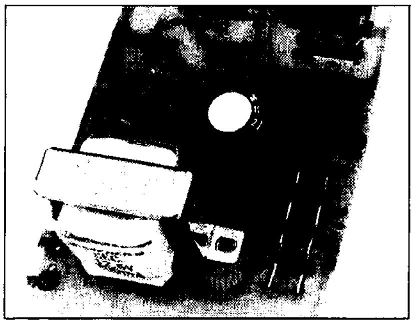


Photo H. Placement and orientation of transformer, diodes D1-D4 and regulator Q3.

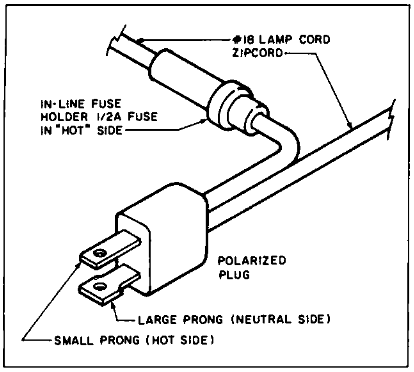


Figure 4.

and "B" to switch S-1. Unsolder wire point "C." Its only purpose was to test the power supply section and it will no longer be needed.

Temporarily tack-solder a 10kΩ resistor in parallel with R8. This will cut the main timing (15 minutes) cycle down to about 30 seconds for test purposes.

Circuit Test

Observing CMOS precautions, install IC chips 1, 2 and 3. Looking at the PC board with the transformer on the right side, the #1 pin of all three IC chips should be at the top left corner of the chip. Check the board one final time, then plug in the line cord and push the pushbutton switch. D6 should illuminate. Approximately 20 seconds later, the tone should sound for 1 second, and D6 should go off about 10 seconds after that.

Once this is confirmed, unplug line cord, remove IC's 1 and 2 and solder in Q4. Q4 should be positioned so that the side with the numbers is facing toward D1-D4. Solder the wires in the two holes marked "LOAD" and connect them to the female line plug. Unsolder the test line cord from points "D" and "E"-install a permanent line cord in points "D" and "F." Wire a switch (S2, SPST) in series with a panel-mount fuse, and solder the switch wire to the second hole at point "F," and the fuse wire to point "E."

The entire project was mounted in a plastic box made of ¼-inch plexiglass. If a metal box is used, *be sure to isolated the PC board from the metal.*

After all the soldering is completed-check for bridges and splash, then reinstall IC's 1 and 2. For the final test, plug a 75 watt (or less) lamp into the female line socket, (LOAD) for visual confirmation of proper operation. If everything works properly, clip the 10kΩ resistor off of R8, mount S1, S2, fuse holder, and the speaker, into the box. Switch S1 may or may not turn the project on (the reset button might have to be pushed again), but it **should always turn the project off!** The project does its job if it switches S1 off.

Use a ½-amp fuse in the holder. Without heatsink or modifications, this circuit will safely handle a 50 watt or less soldering iron.

A few words of caution: CMOS chips and line voltage have contradicting safety procedures. In working with CMOS, the user should use a grounding wrist strap connected to a good ground. In working with line voltage, the builder should **never** be grounded, **period!** Do one then the other. If in doubt of CMOS procedures, skip the grounding wrist strap...it would be better to zap a chip than zapping oneself!

Construction Hints

Rather then looking at D6 through the clear box, put extension wires on D6 and mount it on the box. A socket for IC3 can be made by cutting an extra 14-pin socket in half.

The solder iron holder on top of the box is constructed of #14 (or larger) copper wire folded double and twisted together tightly in an electric drill. It was then formed into a spiral shape using a large paint brush handle as a form. Form a small loop at the bottom for a 6-32 bolt and nut to hold it in place.

Radio Shack has some excellent "bulk" packages, resistor pack #271-312, transistor pack #276-1617, or LED pack #276-1622 to name a few. While these will drive up the initial cost, they make good "junk box" fillers.

All questions accompanied by SASE will be promptly answered. ■

[1] "TV TURNOFF" by Jeffrey A. Sandler, April 1979 *CQ Magazine*.

Parts List

Part	Radio Shack Part #
R1-33kΩ	271-040
R2-2.2MΩ	271-061
R3-10kΩ	271-034
R4-33kΩ	271-040
R5-2.2kΩ	271-027
R6-33kΩ	271-040
R7-10Ω to 100Ω (VOLUME)	271-005
R8-1MΩ	271-059
R9-470Ω	271-019
R10-390Ω	271-131
C1-1000uF 25 v radial	272-1032
C2-10uF 25 v radial	272-1025
C3-10uF 25 v axial	272-1013
C4-.01uF 25 v disc	272-1065
C5-1000uF 25 v. radial	272-1032
C6-.01uF 400 v disc	272-131
C7-.01uF 400 v disc	272-131
D1-1N4004	276-1103
D2-1N4004	276-1103
D3-1N4004	276-1103
D4-1N4004	276-1103
D5-1N914	276-1122
D6-L.E.D.	276-041
IC1-MC14011	276-2411
IC2-MC14011	276-2411
IC3-MOC3010	276-134
Q1-2N2222 or NPN equivalent	276-2009
Q2-Same as Q1	
Q3-LM7812	276-1771
Q4-Triac 6 amp 400 volt	276-1000
Miscellaneous:	
Wire	
M.O.V.-Opitional	276-570
Transformer-12.6 volt AC 300mA	273-1385
Switch S-1 S.P.S.T.	275-602
Switch S-2 N.O. Pushbutton	275-1547
Fuse	270-1271
Socket 117 V	
Socket 14 pin IC (2)	276-1999
Speaker 8Ω	40-245
Line Cord with Plug	
Fuse holder	270-264a
Printed Circuit Board	

(An etched and drilled printed circuit board is available for $8 postage paid from Robert Krieger, Jr., P.O. Box 3385, Davenport, IA 52808.)

ATV

Ham Television

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

DAYTON ATV SESSIONS

The Dayton Hamvention is now history! April 29, 30, and May 1 will be embedded in the memories of many forever. Nearly 30,000 amateurs saw beautiful weather with weekend temperatures in the 70s and sunny skies at the world's largest hamfest. As usual, the Dayton Amateur Radio Club put on a fine show, maintained excellent crowd control, and provided much help to all.

It was good to see so many hundreds of ATVers, to renew old acquaintances and make a few new ones. The USATVS/Spec-Com Journal-sponsored "ATV Workshop" sessions were on Friday and Saturday nights at the Ramada Inn North, just off the I-70 and I-75 on Little York Road. A total of 106 registered "Fast Scanners" attended the two-day informal get-together. Several attendees missed official registration, and head counts on both nights tallied up a total of about 130. This was the best attended Dayton ATV Workshop session ever.

We met in the Ramada's moderate size meeting room, a step up from the converted suite we all crammed into in past years. The same room has been reserved for the 1989 Hamvention.

Some suggested meeting where the SSTVers are, at the nearby Holiday Inn North. We did that one year, and it didn't work out so well—most don't operate both FSTV and SSTV modes. We need two nights exclusively for FSTV to bring in all the speakers and scheduled events.

Took a Little Soaking

Also, the USATVS and *Spec-Com Journal* always lose money by holding these meetings. One dollar per registration more than covered the $50 rent for the meeting room, but we sold beer and pop at a *fifty cents per can* loss. We did not recoup the rent of the overhead projector ($25) or the color TV and VHS VCR ($100). Maybe now you will see that a few book sales, subscriptions, and the dollar per night charge fell quite short of actual operating costs. It's called a "thank you" for the support of our *Spec-Com Journal* and USATVS Organization, and a contribution payback to the amateur radio hobby.

Friday Night

We had, without a doubt, one of the best technical speaker lineups and entertainment programs ever for the two evening ATV Workshop sessions! We kicked off the meetings on Friday evening with a VCR tape, "This is Amateur Television," produced by W7SRZ and The Seattle Washington ATV Society. Many were delighted with the professional production of the program's contents. Next, Henry Ruh KB9FO showed a very funny production, called "Ham Police." Would 'QCD really have jumped off the 501st floor of a downtown Chicago apartment building just to give N9AB a few extra points in working an HT Air-Mobile? I guess we'll never know.

Gerald Cromer led an informal discussion with me on the use of horizontally polarized gain Alford Slots, and how ATVers are now installing them on several ATV repeater systems across the country. Results of a recent Iowa and South Carolina measuring event were given out as well as mention of these antennas to be entered in Sunday's VHF/UHF Antenna Measuring Contest at Dayton. Mike Bogard KD0FW (Kansas City), Ron Cohen K3ZKO (Philadelphia), and Roily Paulson KB0GL (Minneapolis/St. Paul) all commented on how well these designs were working in their areas. John Shaffer W3SST (York, PA) expressed, as did others, their interest in these designs as well for their local ATV/R systems. Technical building sheets were passed out on both the K4NHN and W9DNT designs.

Mike Sheffield ZL1ABS from Auckland, New Zealand, gave an interesting short talk about Fast Scan TV operations in the 600 MHz band "way down under." Mike stayed with me here in Iowa for about a week and spent some time with Henry Ruh KB9FO in the Chicago area as well. He left for a short visit with relatives again in Chicago after Dayton before traveling down to see Dr. John Fox WB2LLB in Birmingham, Alabama. It was fun to meet Mike and hear all about New Zealand Ham-TV!

Bill Parker W8DMR of the of the ATCO ATV Group in Columbus, Ohio, gave an exciting technical lecture on the study of AM versus FM TV. Bill is an excellent, dynamic speaker. I cornered him in the flea market Friday morning and asked him if he would like to speak at our ATV workshop session. Bill gave a magnificent talk, complete with a remote controlled slide projector of 90 edited color slides. He answered a lot of questions about FM-TV, especially on the pros and cons of using it on a future Space Shuttle mission.

Hap Griffin WA4UMU of the Palmetto, South Carolina, ATV group talked further about Slots and their Portable ATV in the Sky event using a FSTV transmitter and camera on a remote controlled aircraft. Videotape was shown on the highlights of the event. Andrew Emmerson G8PTH and Trevor Brown (not Howard) G8PYH were introduced, said a few words about their upcoming Saturday talks. Bill Brown WB8ELK of the Findlay, Ohio, ATV group was presented the USATVS/Spec-Com Journal 1987 "Good Image Award" (1952 orthocon image camera tube mounted on plaque) for his exciting promotional and pioneering work and operations on ATV! Bill then gave an hour long presentation on the Helium Filled ATV Balloon Flight (last summer), and ATV in Ohio. The Friday night meeting officially broke up around 12:30 in the morning. An international breakfast Pizza Run crew reassembled at 2 AM in the meeting room, to fortify eight hearty sleepless ATVers.

> ***"This was the best attended Dayton ATV Workshop session ever."***

John Shaffer W3SST gave a brief update on the York, Pennsylvania ATV group and ATV/R antenna system. He invited us all to the 33rd Annual York Hamfest and Computer Show that will be held this year on September 24 and 25 at the York Fairgrounds. (For more information, send an SASE to Membership Services or write direct to York Hamfest, PO Box W, Dover PA 17315.) The USATVS hosted one of its many fall ATV conferences in York a few years ago, and is considering doing so again in 1988. Watch the next few issues for any possible announcement.

SSTV Get-Togethers

Our SSTV columnist Fred Sharp W8ASF will be giving us the details of what went on at the Holiday Inn North at the Don Miller W9NTP SSTV evening meetings. Don's Saturday afternoon SSTV Hamvention forum (1345–1500, Room 3) included Tom Hibben KB9MC of "TTL Robot 400 Meets Computer VLSI." W8ASF gave a taped talk presentation on his latest mods to the Robot 400. A "Blinky" tuner was given away as a door prize.

W6ORG Forums

Tom O'Hara W6ORG did his best, but tried to combine too many speakers in too short a time (an hour and three quarters) at this year's event. We need either longer periods or fewer speakers. Tom gave a lengthy talk about his new 33 cm (902–928 MHz band) equipment, and once again during the question and answer session denied the existence of good gain, horizontally polarized "omni" antennas for ATV. (I kept quiet for once while passing out slot literature to the crowd).

Bill Brown WB8ELK gave a quick presentation on his 1988 Summertime Helium-Filled Balloon Event. John Gebuhr WB0CMC showed a separate video and sound transmitter duplexer. Steve Goode K9NG gave a fast talk about Fast Scan Amateur TV for the space shuttle based on the Chicago Motorola N9AB proposal. Surprisingly, no one asked him about the news item in *Westlink* that reported that NASA shot down the N9AB proposal. (I was at the Repeaters Coordinators Conference meeting at the time.)

Time was running out when Andy Emmerson G8PTH and Trevor Brown G8CJS spoke to the packed crowd in the meeting area. The British guests commented later on at the USATVS ATV Workshop that they were quite disappointed at the short amount of time that they got, and at being placed at the end of the agenda after traveling so far and at so great an expense. Once again, no one was introduced from the audience, so we all sat next to each other not knowing

who each other was (something that we always correct at the beginning of our workshop sessions).

Saturday Night Workshop

The Workshop meeting room opened up about 5:30 p.m. on Saturday. Portions of the "Hello From America" videotape were run. Hap Griffin WA4UMU gave a short presentation on the Palmetto, South Carolina ATV group's remote controlled aircraft special event mentioned earlier. John Gebuhr WBØCMC of the Omaha, Nebraska, ATV group, gave a technical talk and spectrum analyzer demo talk on homebrew interdigital diplexers for ATV use. I welcomed and introduced our two British guests sent over by the BATC–Andy Emmerson G8PTH and Trevor Brown G8CJS, accompanied by yet another English ham, Steve Mitchell G8JMJ. The master "Hello from America" videotape was presented to Andy and Trevor, and G8PTH quite graciously accepted the six-month, edited 2-hour tape depicting ATV operations in the United States. Both promised a return tape of European ATV activity by this time next year back to the USATVS.

Andy and Trevor then talked with great captured interest from the crowd on what ATV is like in the UK, and showed us some new books that are available. Many questions came from the audience on FM TV and the availability of boards, circuits, and negatives not available here in the USA from present ATV manufacturers. They announced that Don Miller W9NTP was the sole agent for handling USA BATC Club Memberships and the sales distribution of books and other materials. (The cost of subscribing to the BATC in America was about three times as much as it will be now via the Wyman Research connection. We swapped a lot of books from the USA for their British books and some are available to USATVS members.)

"(Bill W8DMR) answered a lot of questions about FM-TV, especially on the pros and cons of using it on a future Space Shuttle mission."

John E. Thomas of Lindsay Specialty Products of Lindsay, Ontario, spoke for a few minutes about their unusual line of UHF TV antennas. Lindsay Products had a booth at the Hamvention and is looking to expand into the amateur UHF market. They are most interested in the work of W9DNT and K4NHN on the successful Alford Slots for ATV/Rs, and would like to build and further develop these antennas for worldwide distribution. Thomas handed out brochures depicting their 150,000 square foot plant in Ontario containing 350 employees. Lindsay makes cable TV (headend) antennas, and expanded into the amateur market in 1969. He can be contacted at 50 Mary Street, Lindsay, Ontario, Canada K9V-4S7 or called at (705) 324-2196.

Don Miller W9NTP of Wyman Research showed off his new FM goodies around 10 PM. Don has a fine new line of FM ham TV gear and components imported from Europe. One of Don's new pieces of gear that he was also showing at his booth at the Hamvention was a separate on-carrier sound receiver adapter box. For $85, a user can take this little box, place it in line where the Channel 2 or 3 "F" cable goes to the TV set, and it samples the line on its own mounted speaker. One can hear quality FM on-carrier sound transmissions! Don is aggressively filling a lot of the voids in ATV availability, and is listening to and responding to customer requests for new products, something of which all manufacturers should take note. Bill WB8ELK for the *third* time gave the presentation of the balloon flight and DX as seen in Ohio. Bill also showed off his new invention of a 6809 microprocessor, automatic switching, and "mini" ATV video board (see ad).

John Beanland G3BVU of Spectrum International, Inc., showed up and gave a late-night projector screen presentation of how interdigital filters really react to QRM and other types of interference. Saturday night's session lasted until about 1 AM. The same Friday night Night Owl Club had a meeting at a local 24-hour Bob Evans Restaurant on Saturday morning. Of course, the BATC, New Zealand, and USATVS were well represented! ■

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, MD WA3AJR
6 Jenny Lane
Baltimore MD 21208

August may mean the end of the summer is near, with the hot and muggy "dog days" here in in Maryland, but with the readership this magazine gets, I try not to assume anything. After all, to our readers in Australia—and from the letters I receive from Down Under I know there are a lot of them—it is getting near spring! Either way, I think I have at least one more excuse to spend some time in the hamshack this month.

Before getting into the topic in earnest, I wonder if the scenes of Peterborough in the winter we all saw on "St. Elsewhere" were accurate. If so, this magazine is published in a very, very beautiful town, and I have a better feeling for why Wayne likes it so much. *(I've said so many times this is almost Paradise—NA5E).*

AEA PC Pakratt

I promised RTTYers a fancy commercial program last month, and fancy it is. Many have read of my admiration for the AEA PK-232 RTTY interface. One problem with it is the sheer complexity of its programming. Well, AEA has addressed this need with a dedicated program for PC-type computers which manages to wring every bit of performance out of the PK-232.

The PC-Pakratt Terminal Program runs on "100% compatibles," with 320K or more of RAM, a serial port, two 360K floppy drives (or one 360K floppy and a hard disk), and PC-DOS 2.0 or later. The manual *doesn't* specify MS-DOS—contact AEA before using this program on a Tandy or other "close clone." The manual hints that a flight simulation game, known to be finicky with different DOS, might be a good measure of suitability.

The program supports a printer, and has the ability to use a slower, impact style, printer with a buffer, or an Epson-type printer, which could also be used to print FAX pictures.

Help!

Fortunately, this relatively complex program has a "help" facility. Pop-up windows, called up by the F1 key, show options for where the user is, or details of a highlighted command. Other function keys initiate many program command processes, with the ability to define Shift- or Alt-function key combinations to encode up to twenty 256-character sequences.

The display is tailored to the user's current mode. In packet, for example, windows display connect status, and other information shows link state, transmit channel, and other vital information. In Morse mode, three windows display received and transmitted data, as well as transmit/receive status and speed.

Similar screens are used for Baudot and AMTOR operation. The digital ham can keep just about everything he needs to know onscreen at one time. FAX operation is a bit different, of course, with only status and transfer information onscreen—actual reception is diverted to the printer. (Don't confuse the FAX mode on this program with the AEA PC-FAX program, which diplays the image on a screen.)

Throughout, disk functions, such as directory listing, copying files, deleting files, and the like, remain accessible. A virtual symphony of function key assignments helps make operating in any of the PK-232's modes as easy as typing on a computer.

There still may be times, however, when the user might want to return to the "old" way of running the PK-232. This would particularly be the case when using the SIAM mode, discussed here a few months ago. This mode lets the user identify and print unknown signals. AEA thoughtfully provided a "dumb terminal" mode to deal with the unknown signals. Hitting the right key gives a blank screen, which depends on the digital ham's understanding of the PK-232 to issue the proper commands.

Finally, there's a utility to allow the operator to look at all those messages he has received, and write replies. This simple editor resembles WordStar™ setup.

All in all, this represents quite a valuable program, especially for less than $30. Those interested in more details from AEA should drop them a line at Advanced Electronic Applications, Inc., 2006 196th SW, Lynnwood, WA 98036-0918. Tell'em RTTY Loop sent you!

Amiga Info

Harvey A. Nelson N9FHO of Stevens Point, Wisconsin, passes along some information for Amiga computer users. He says that a public domain program called COMM (Version 1.34) is available on "FISH DISK #75." I assume all you Amiga owners understand that reference.

He says that after making a set of F-key macros for each mode, such as packet, AMTOR, and RTTY, the program is at least the equivalent of PC-Pakratt, with all the bells and whistles.

Harvey offered to send a copy of the program configured for the Amiga to run a PK-232 to readers who send him a blank 3 ½ inch disk and stamped mailer. Drop him a line at PO Box 736, Stevens Point, Wisconsin 54481. Thanks, Harv, for the service to the readership!

RTTY Boat Anchors Revisited

Finally, June's issue of RTTY Loop detailed some of the "classic" teleprinters many readers grew up with. This encouraged Bill McCollum KAØZFZ of Omaha, Nebraska, to drop me a line with some of the machines and history I omitted.

The Teletype Corporation was founded by Joy Morton and Charles Krum, back in the halcyon days of digital communications. In fact, they adopted the trademarked name "Teletype Corporation" in 1929. Long a subsidiary of Western Electric, the Corporation ceased to be when divestiture took its toll in 1984. The June column's look at Teletype products in June ended with the late great Model 33. Here's a peek at some of the other machines.

Model 37: This "nightmare" of a machine ran at 100 wpm in Baudot or 150 bauds ASCII. With seven clutches for horizontal and vertical positioning, and a retraction mechanism to lower the type box to allow the print to be viewed, I can see why it was so deemed.

This unit printed both upper and lower case, and supported a reverse full- and half-line feed, and vertical and horizontal tabs. An integral tape reader could handle both five- and eight-level material, with code conversion performed on an inboard circuit card. These units found favor with the military, but apparently never really circulated much in the general market.

Model 38: A wide carriage version of the Model 33, this 132 column monster printed both upper and lower case, and even sported red and black ribbons. At 110 bauds it was slow, though, particularly when chugging along the full width of the carriage.

Model 42: This is the end of the Baudot line, as far as I know, with a dot matrix output, and able to accept TTL, current loop, or RS-232 interfacing. Tape equipment is also available for this model.

Model 43: The ASCII version of the Model 42, this is a similarly modernized teleprinter. Buffered versions of this machine are available that can run at higher speeds.

Non-Teletype Teleprinters

The Teletype Corporation, however, was not the only company making Teleprinters. The Kleinschmidt line, in particular, has often been a staple of amateur RTTY stations. While some amateurs swore at them, and some by them, those who used them regularly—particularly European amateurs who could not get Teletype Corporation products—seemed to have a good deal of success with the line.

Then there was the Mighty Mite. This unique teleprinter was made by the Mite Corporation (did they ever make anything else?) and was a mobile unit which presaged today's Packet-In-A-Box attaché case. I saw one or two back in the late 1960s, usually available through the MARS system. The one thing I remember most was that parts were few and far between, which left quite a few Mites languishing on shelves.

Computers, Anyone?

Once again, a reminder about the newest feature of the Loop. Popular opinion has uncovered an acute interest in various aspects of computing, which I shall be delighted to cover here. Only problem is, where do I begin? For that, I ask the reader's input.

Interest remains quite high on the various programs and reprints available from past editions of RTTY Loop. Send me a self addressed, stamped envelope for the latest list. Of course, I remain present on both CompuServe (ppn 75036,2501) and Delphi (username MARCWA3AJR), and try to answer questions posed there as quickly as possible. Be sure to see what's new next month in RTTY Loop! ■

AERIAL VIEW

Antenna News

Arliss Thompson W7XU
7314 SW 28th Ave.
Portland OR 97219

Transmission Line Transformers

Matching the impedance of an antenna to the impedance of its associated transmission line is a common problem. For example, a ¼ wave ground plane antenna typically shows a resistive impedance near 35Ω. If fed with 75Ω line, an SWR of 2.14:1 would result. In order to reduce the SWR to 1:1 (not always necessary) some means of impedance matching must be used. There are a number of ways to achieve an impedance match; the use of a transmission line transformer is one. Judging from comments received from readers, there isn't only considerable interest in this method of impedance matching, but also some confusion. Therefore, this month's column is devoted to the design and use of transmission line transformers. While some mathematics will be involved in the discussion, a BASIC computer program is included to simplify the use of information provided.

Transmission line transformers are sections of transmission lines that match the impedance of the antenna to that of the main feedline. They are inserted in series with the regular feedline, between the transmitter and the antenna. These matching sections, if properly designed, can be of nearly any characteristic impedance so long as it is not too near the impedance of the primary transmission line. They can be manufactured from commercially available coaxial cable or homemade open-wire line. Since they do not require the use of distinct coils and capacitors, they are also know as linear transformers. They can take a variety of forms, including the stub-match, the alternated-line match, and the series section transformer. Another variation, and the one with which hams are most familiar, is the quarter wave transformer.

Quarter Wave Transformers

The quarter wave transformer (or "Ω" section) is an electrical ¼ wavelength of transmission line, connected in series between the main transmission line and a mismatched non-reactive load (i.e., a resonant antenna). In order to perform its matching function, the quarter wave line must have a specific characteristic impedance. That impedance can be calculated with the equation:

$$Z = \sqrt{(Z_L Z_0)}$$

where Z_L is the impedance of the antenna, and Z_0 is the characteristic impedance of the main transmission line. In the opening example, the antenna impedance was 35Ω and the transmission line had an impedance of 75Ω. Using the above equation:

$$Z = \sqrt{(35 \times 75)} = 51.2\Omega$$

Thus, a quarter wavelength of 50Ω coax placed between this antenna and its 75Ω feedline would result in a 1:1 SWR on the 75Ω line and at the transmitter. This would have to be an electrical quarter wavelength of 50Ω coax, meaning that the velocity factor of the line must be taken into account. For a solid dielectric line, the velocity factor is 0.66 requiring the length of coax to be 66% of the length of the free-space ¼-wavelength. In general:

$$\text{Length (feet)} = 246\ VF/f$$

where VF is the velocity factor and f is the frequency in MHz. Specifically, at 28 MHz:

$$\text{Length} = 246 \times 0.66/28 = 5.8' = 5'\,9\tfrac{1}{2}''$$

More examples will be provided later. Also, the computer program mentioned above can solve these calculations with minimal effort.

Series-Section Transformers

The quarter wave transformer works well when the antenna shows only resistance to the feedline. There are times when it is necessary to match a reactive load to the feedline. The series-section transformer can provide that match. In fact, the quarter wave and other linear matching transformers mentioned are special cases of the series-section transformer. Surprisingly, many hams are not familar with this more general form of transformers.

Unlike the quarter wave transformer, the series-section transformer does not require the matching section to necessarily be placed directly at the antenna terminals. Depending on the impedances to be matched and the characteristic impedance of the matching section, it may be placed as far as ½ wavelength from the antenna. The impedance of the matching section may be either greater than or less than the main feedline, as long as the two are not too close in value. Also, unlike the quarter wave transformer the series-section transformer may be considerably shorter than an electrical quarter wavelength in length. In summary, the series-section matching unit allows more flexibility in design compared to the Q-section.

```
100 CLS
110 PRINT "DESIGNING SERIES-SECTION AND QUARTER-WAVE TRANSMISSION LINE
TRANSFORMERS"
120 PRINT:PRINT "ENTER DESIGN FREQUENCY (MHz) "
130 INPUT F
140 PRINT "CHOOSE SERIES-SECTION OR QUARTER-WAVE DESIGN (S OR Q):"
150 INPUT K$: IF K$= "Q" GOTO 1000
160 IF K$= "q" GOTO 1000
170 PRINT "ENTER ANTENNA IMPEDANCE RL + jXL   (RL, XL):"
180 INPUT RL,XL
190 PRINT "ENTER CHARACTERISTIC IMPEDANCE AND VELOCITY FACTOR OF MAIN
TRANSMISSION LINE        (OHMS, VF):"
220 INPUT ZO, VF1
210 PRINT "ENTER CHARACTERISTIC IMPEDANCE AND VELOCITY FACTOR OF MATCHING
SECTION        (OHMS, VF):"
220 INPUT ZM, VF2: CLS
230 N=ZM/ZO: R=RL/ZO: X= XL/ZO
240 C=SQR((RL+ZO)*(RL+ZO)+X*X)
250 D=SQR((RL-ZO)*(RL-ZO)+X*X)
260 SWR1=(C+D)/(C-D):SWR2=(C-D)/(C+D)
270 IF ZM>ZO*SQR(SWR1) THEN 340
280 IF ZM<ZO*SQR(SWR2) THEN 340
290 PRINT "IMPEDANCES OF MATCHING SECTION AND MAIN TRANSMISSION LINE ARE TOO
CLOSE":PRINT
300 PRINT "OLD IMPEDANCE OF MAIN TRANSMISSION LINE WAS": ZO; "OHMS   ENTER NEW
VALUE "
310 INPUT ZO: PRINT
320 PRINT "OLD IMPEDANCE OF MATCHING SECTION WAS": ZM; "OHMS.  ENTER NEW
VALUE."
330 INPUT ZM:CLS GOTO 230
340 BO=R*(N-1/N)*(N-1/N)-(R-1)*(R-1)-X*X: IF BO<0 GOTO 290
350 BN=(R-1)*(R-1)+X*X
360 B=SQR(BN/BO)
370 AD=R+X*N*B-1
380 AN=(N-R/N)*B+X
390 A=AN/AD
400 L1=ATN(A)/1.745329E-02
410 IF L1<0 THEN L1=L1+180
420 LA=L1/360*984/F*VF1
430 L2=ATN(B)/1.745329E-02
440 LM=L2/360*984/F*VF2
450 PRINT "DESIGN FREQUENCY = ";F;" MHz":PRINT
460 PRINT "MATCHING SECTION": PRINT "        IMPEDANCE= ";ZM;" OHMS":PRINT "
LENGTH= ";LM;" FEET"
470 PRINT: PRINT "MAIN TRANSMISSION LINE": PRINT "      IMPEDANCE= ";ZO;"
OHMS":PRINT "      LENGTH BETWEEN ANTENNA NAD MATCHING SECTION= ";LA;" FEET"
480 PRINT: PRINT "DO ANOTHER? (Y/N)"
490 INPUT W$
500 IF W$= "N" THEN END
510 IF W$= "n" THEN END
520 CLS: GOTO 120
1000 PRINT "ENTER ANTENNA IMPEDANCE IN OHMS (NO REACTIVE COMPONENT ALLOWED) "
1010 INPUT ZL
1020 PRINT "ENTER CHARACTERISTIC IMPEDANCE OF MAIN TRANSMISSION LINE (OHMS)"
1030 INPUT ZO
1040 ZM=SQR(ZL*ZO): LA=0: L2=90
1050 PRINT "QUARTER-WAVE MATCHING SECTION WILL HAVE AN IMPEDANCE OF ";ZM;"
OHMS  ENTER IT'S VELOCITY FACTOR"
1060 INPUT VF2
1070 CLS: GOTO 440
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The chief disadvantage of the series-section transformer is its design is more complicated than the quarter wave transformer. The mathematics, however, are not too involved for a hand-held calculator, and are made easy with a programmable calculator or a personal computer. The BASIC listing handles both Q- and series-section transformer calculations. For those wishing a more thorough discussion of series-section transformers, including the mathematical formulas involved. Further information can be found in Regier's article "Series-Section Transmission-Line Impedance Matching," *QST*, July 1978, pp 14-16 and in the 1987 ARRL Handbook, pp 16-4 and 16-5.

Here's an example of how a series-section transformer may be used. Consider again the ground-plane antenna of the first paragraph. It had an impedance of 35Ω, with a 75Ω feedline. The operating frequency was 28 MHz. Assuming the feedline is replaced with some 50Ω coax (velocity factor of 0.66). A quarter wave transformer, designed to match the antenna to the new coax, would need to have a characteristic impedance of 41.8Ω ($\sqrt{(35 \times 50)} = 41.8$). That seems simple enough until one goes shopping for 42Ω coax!

While it might be argued that the SWR, resulting from feeding a 35Ω antenna with a 50Ω line, is rather low. There are times when it is desirable to have a near perfect match. By using a series-section transformer a 1:1 match can be achieved on the main transmission line. Leaving the number crunching to the computer, it can be shown that the 50Ω feedline to this antenna is cut 7.82' from the antenna and a 1.64' length of 75Ω coax (velocity factor of 0.66) is inserted at that point, the SWR at the transmitter will be 1:1.

More Examples

Antenna 2 is a wide-spaced quad on 21.2 MHz with a feedpoint impedance of 80Ω. With a 50Ω coax feedline (VF= 0.66), a

Q-section would require 63Ω coax (hard to come by) to achieve a match. An alternative would be a 3.53' long series-section transformer of 75Ω foam dielectric coax (VF = 0.79) inserted in the feedline 2.26' from the antenna.

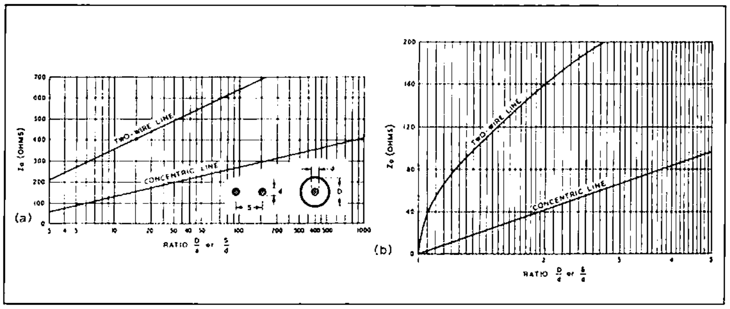


Figure 2. These graphs illustrate characteristic impedances of two-wire and coaxial (concentric) lines versus wire diameter and spacing. The calculations have assumed air insulation. When the space between the wires is filled with an insulator, the impedance given by the chart must be divided by the square root of insulator (dielectric) permittivity, or dielectric constant. The resulting ratio is the velocity factor, because wave velocity through the transmission line is reduced by the same factor. (Courtesy RSGB Radio Communication Handbook, *Fifth Edition.)*

Antenna 3 is a vertical being used on 3.9 MHz. Measurements with an antenna noise bridge shows it has a base impedance of 30 - j10Ω. The feedline is 50Ω coax; the matching section is 75Ω. Both have velocity factors of 0.66. The series-section solution to the problem is a 20.3' length of the 75Ω coax inserted in the 50Ω line, 59.6' from the antenna.

For a final example, consider a 20m yagi with a feedpoint impedance of 25Ω. Presuming a frequency of 14.25 MHz, with a 50Ω transmission line and a 75Ω matching section (both with VF = 0.66), the system can be matched if a 7.35' piece of the 75Ω material is inserted in the main transmission line 13.3' from the antenna. To use a quarter wave section, in this instance, would require the fabrication of a 35Ω line for a matching section. The series-section transformer obviously provides an easier solution.

It should be apparent from these examples of the series-sections transformers, can be very versatile. They permit matching of a wide range of transmission lines and antennas with commonly available materials. Why not load the accompanying BASIC program into a personal computer and see how the transmission line transformers can solve a host of antenna-feedline matching problems?

Some tips

The BASIC program referred to here was written to run on an IBM clone. It should, however, run with few or no modifications on other machines equipped with BASIC. Also, be aware that this is a "bare-bones" program written to familiarize readers with the principles of transmission line matching. Amenities can be added as the user sees fit. As it stands, its main shortcoming involves calculations for a series-section transformer when the impedance value, of the matching section chosen, is very close to the requirement for a quarter wave section. This difficulty arises from the way the computer handles the equations involved. The problem is bypassed by incorporating a subroutine that handles the calculations for Q-sections. There are undoubtedly more elegant solutions to this problem, but they are left for the user to discover.

Feedback

Readers are encouraged to write to me with their questions and suggestions. I am happy to provide examples for this column's material and type for running the program on non-IBM clone machines. I welcome suggestions on new types of antennas or old antennas in new situations. Don't forget to enclose an SASE for a reply. 73

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5Z1B
14714 Knightsway Drive
Houston, TX 77083

HELPING HAND

Automatic control of rigs and antennas simplifies satellite operation. While tuning through the transponder passband, it's helpful to have an extra hand to work the rotators or keep the transmitter frequency locked to the receiver, during a low-orbit Fuji-OSCAR-12 pass.

Automated satellite tracking was covered in the February 1987 Hamsats column here in *73*. Since then, new options appeared as construction articles and products for sale from manufacturers.

The May and June 1987 issues of *QEX* contained a two-part article by Frank H. Perkins, Jr. WB5IPM, detailing a "Computer Interface for the Kenpro KR-5400A." It is easy to reproduce the circuit board for the project, using the layout shown in part one of the article. The parts are available from Radio Shack. The completed unit was tested on a Radio Shack TRS-80 Model 100. It was connected to the printer port and included a program in BASIC for F-O-12 tracking. Since the system presented by Frank is wired in parallel to the existing rotator control wiring, the computer need not be on to run the elevation and azimuth rotators manually. This is an advantage for passes shorter than the set-up time for the computer program.

Another construction article for a computer-to-rotator interface appeared in the December 1987 issue of *Ham Radio*. The author, Neil Hill K7NH of Mountainlake Terrace, Washington, included all the information for "A Simple Interface Board for the C-64 and the VIC-20." The analog to digital IC's are a bit difficult to find, but the unit takes very little time to build and will work with several different rotators, including the Yaesu/Kenpro series and the Alliance HD73.

The circuit boards are double-sided and may be difficult for the casual garage etcher, but Neil sells them for a nominal $20, including shipping. The project was based on previous efforts to market an interface for the Timex 1000 computer by Spectrum West of Seattle. Operation and alignment are easy and the unit is an excellent use for older Commodore computers.

For those wishing to buy rather than build, there are two sources of Yaesu/Kenpro interfaces. Encomm of Plano, Texas, and L. L. Grace of Voorhees, New Jersey, sell packages providing useful alternatives.

Encomm has two systems. Each is built for the Yaesu/Kenpro KR-5400A or KR-5600A dual-control boxes. The KR-001 works with the Commodore C-64 while the KR-010 is designed for IBM PC's and their clones. The price for either unit is $199.95. Check on availability by phoning (214)-423-0024. Encomm does not provide software for the C-64 version, but the units have been designed to work with software by N4HY from AMSAT NA. The KR-010 is supplied with information on how to use the AMSAT NA software by N4HY, WØSL and W3IWI. Details on program availability can be had for an S.A.S.E. to the AMSAT NA Software Exchange, P. O. Box 27, Washington, DC 20044.

L. L. Grace Communication Products offer several options to their "Kansas City Tracker" interface.

The basic unit is intended to connect between the Yaesu/Kenpro 5400/5600 rotor controller and an IBM XT, AT or clone, controlling the antenna array for automatic satellite tracking. The software included in the package is compatible with AMSAT's QUIKTRAK (3.2) and with Silicon Solution's GRAFTRAK (2.0). These programs can be used to load the Kansas City Tracker's orbit tables. Then the rotator driver and status programs can operate as a Terminate-and-Stay-Resident (TSR) program. This allows the computer to be used for other purposes, like data communications via F-O-12, while pointing the antenna automatically.

The basic package including hardware, software and instructions sells for $169. The interface cable for the Yaesu/Kenpro 5400/5600 control boxes goes for $19. The Kansas City Tracker with interface option to connect to any type of rotator is $199.

Doppler Tuning

Additional options include two versions of the Kansas City Tuner. Either one is used to provide automatic Doppler shift compensation during a pass and must be used in conjunction with the Kansas City Tracker. The first version, at $59, connects to the "mike click" buttons to change the frequency of the radio, to keep received audio at a steady pitch. The second version, at $79, provides the same result but operates through the radio's serial control port via an RS232 connection. The Tuner is compatible with most rigs including the Yaesu FT726R and 736R, the ICOM 271/471, 275/475 and the R-7000. Be sure to call first at (609) 751-1018 during east-coast evenings or weekends concerning the rig to be used.

The Kansas City Tuner can take care of Doppler shift during a pass, but other devices are needed for frequency tracking between receiver and transmitter. Newer rigs like the Yaesu FT736R include frequency tracking in either the normal mode or inverted. In the normal mode, as the receive frequency is shifted upward, the transmit frequency follows. This works for satellites like RS-11. The inverted mode moves the transmit frequency down as the receiver is tuned upward. This is appropriate for F-O-12, A-O-10 and A-O-13.

The Ten-Tec 2510 Mode B transmitter/receive converter also provides automatic frequency tracking. The unit has a 435 MHz SSB/CW transmitter and a two-meter receive converter. The ten-Watt output is sufficient for A-O-10 and A-O-13 uplink when used with a good gain antenna. A 29 MHz receiver or transceiver and a two-meter antenna will complete the Mode B system. Once the 2510's transmitted signal is found through the transponder into the receiver, the 2510 will shift the receive converter to keep receive and transmit operation locked together without further adjustment of the 10-meter rig.

The ICOM 275/475 pair require an accessory from ICOM to allow automatic frequency control. This Satellite Interface Unit, the CT-16, sells for $97.50. Normal and inverted tracking for any Mode B or Mode J (two meters up and 70cm down) satellite is possible with this addition.

The ICOM 271/471 pair needs two additions from ICOM for automatic tracking. First a Communications Level Converter, the CI-5, must be installed followed by the CT-17 interface unit. They are $97.50 each.

An alternative is available for the builder. Tony Card VK1ZZT can provide PC boards and instructions for an interface designed for either the Yaesu FT726R or the ICOM 271/471 transceivers for automatic frequency tracking. The circuits are simple, but it is not always easy to get to the connections inside the radios. Boards must be lifted and jumpers installed in many tight locations. Considering the price of the radios, the easier route may be to buy, rather than build. For those interested in the cost-savings and not worried about keeping the equipment in stock condition, contact Tony at 44 Champion Cres., Flynn, Australian Capital Territory 2615, Australia.

Hearing Aid

One additional note on the Yaesu FT726R: The two-meter receiver in this radio lacks performance. In the July 1987 issue of *Ham Radio*, Peter Bertini K1ZJH, wrote an article called "Improved Gain Distribution for the Yaesu FT726R." Adding three capacitors, two resistors, a choke and a transistor really helps. The receiver sounds better and exhibits about a 12 dB gain improvement. Installing the parts is a bit tedious, and special care is needed with the transistor orientation. The end result is well worth the effort. Weak signals, like those from the satellite, will be easier to copy.

Amateur Radio Satellite Modes

Mode	Uplink	Downlink	Active	Bird(s)
A	145.9	29.5	Yes	RS-10/11
B	435.1	145.9	Yes	OSCAR-10 OSCAR-13
J	145.9	435.9	Yes	OSCAR-12 OSCAR-13
JL	145.9 1269.5	436.1	Yes	OSCAR-13
K	21.2	29.4	Yes	RS-10/11
L	1269.5	436.1	Yes	OSCAR-13
S	436.1	2.4 G	Yes	OSCAR-13
T	21.2	145.9	Yes	RS-10/11
K/T	21.2	29.5 145.9	Yes	RS-10/11
K/A	21.2 145.9	29.5	Yes	RS-10/11

NOTE! The satellite mode designation letter is merely a shorthand way of specifying a particular combination of "Uplink" and "Downlink" bands. Please don't let these letters become confusing!
The current satellite modes are courtesy of AMSAT NA.

73 Review *by Gordon West WB6NOA*

Number 26 on your Feedback card

Going Microwave With The ARR TR10GA 10 GHz Transceiver

Find out here about a fascinating piece of spectrum.

Price Class: TR10GA Transceiver/Gunnplexer

10 mW	$439.95
20 mW	$508.95
35 mW	$570.95
100 mW	$610.95

Advanced Receiver Research
Box 1242
Burlington CT 06013

Hams as fascinated with UHF long distance propagation as I am will love the excitement of using Advanced Receiver Research (ARR) TR10GA 10 GHz equipment. There's no construction or soldering needed. Just add 12 volts, an everyday el-cheapo tape recorder mike, and a set of headphones to the already-assembled transceiver—and you're on the air! It couldn't be any easier to get on 10 GHz, the highest amateur band for which relatively inexpensive ham radio is available.

10 GHz in Perspective

Ten gigahertz is 10,000 MHz. That's ten times a higher frequency as the relatively new 1,200 MHz UHF band on which Novices just received voice privileges. It takes a Technician class license or higher to operate at 10 GHz. The Amateur Radio Service is allocated 10–10.5 GHz.

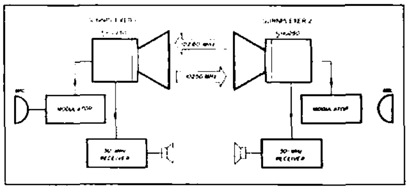


Figure 1. Full duplex operation with pair of 10 GHz transceivers.

While there are four other amateur radio allocations between 1,200 MHz and 10,000 MHz, most microwave enthusiasts stake out at 10 GHz, mainly due to the readily available equipment for that band.

Full Duplex

The most common emission type at 10 GHz is wide-band FM with an incredible bandwidth of 220 kHz! Good thing hams have 500 MHz to play around with here!

Two-way communications are normally centered around 10.250 GHz, right in the center of the band. Beacon stations normally operate near 10.228 GHz, using a Modulated Continuous Wave (MCW) IDer.

Advanced Receiver Research produces the most commonly operated equipment. These units feature wideband FM modulation, a provision for keying a MCW ID tone, and tuning capabilities of at least 60 MHz to each side of the 10.250 GHz center frequency. When ARR transceivers come in pairs, one unit is pre-set at 10.250 GHz, and the other unit is pre-set at 10.280 GHz, offering full duplex (simultaneous talk and listen) communications over some surprisingly long distances, sometimes several hundred miles.

Some microwave experts are switching from wideband FM to SSB, which will no doubt break communication distance records. The most popular mode there today, however, is still WBFM.

Photo A. The author's 10 GHz DX station.

Details of the TR10GA

The ARR 10 GHz sets use a Gunnplexer manufactured by Microwave Associates, Inc., of Burlington, Massachusetts. ARR offers four power-out levels: 10, 20, 35, and 100 mW.

The average price for the 20 mW assembled unit is $500. It's completely assembled and ready to go. Add "3 dB" (twice the price) to buy a pair—they don't offer a discount on the second unit. They come tuned for instant operation right out of the box. Place the order directly with the factory with the owner Jay Rusgrove W1VD. It takes approximately 45 days to complete the order. ARR is working on a number of microwave products, including microwave preamplifiers.

A standard 30 MHz IF is used in the United States so that each transceiver may operate full duplex with another station. Even homebrew equipment stays with the 30 MHz IF to insure that everybody may talk and listen simultaneously. I ordered a pair of 35 milliwatt units, Model TR10GA-35mW, and they arrived packaged expertly to keep things from getting banged up on their way out to California. Both units operated flawlessly out of the box, and they haven't given me an ounce of problems even though they have been banged around on many a mountain-top expedition.

The front of the unit looks like a regular two-way radio. There are pots for mike gain,

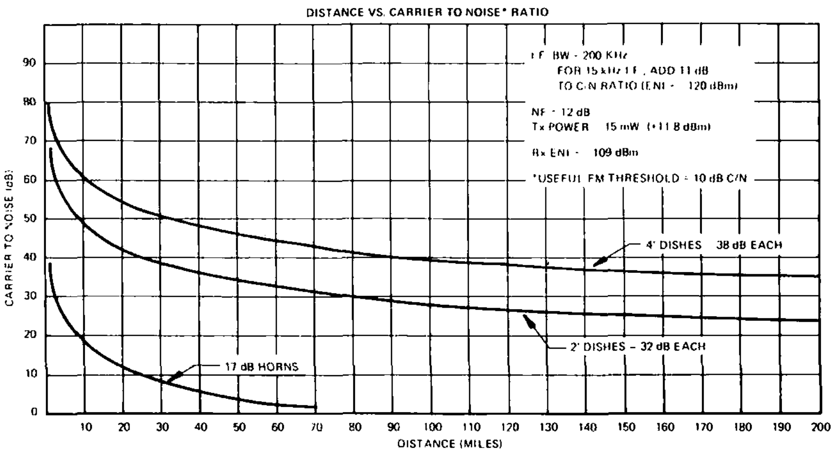


Figure 2. ARR TR10GA Specifications.

squelch, and audio, and jacks for a set of "cans" (headphones) and the mike jack for any high or low impedance mike using the supplied ¼" phone plug.

The AFC switch keeps the transceiver locked to another station on those days the unit gets hot in the sun, and the meter switch allows an op to switch between varactor tuning voltage as well as center position to properly tune in another station. That is viewed on one of the bold, back-lit meters on the front of the unit. The other meter acts as a relative signal strength meter with S-9 working out to be around 30 microvolts to the input of the 30 MHz receiver.

Then, of course, there is the main tuning dial—it would have been nice if ARR provided some calibration marks on the dial for fine tuning to specific frequencies. It is, however, a smooth and responsive dial.

Professional Quality

Construction and circuitry inside the unit is excellent and obviously professionally done. ARR puts together everything but the actual Gunnplexer device.

The Gunnplexer contains a Gunn oscillator that generates both the transmit power and the receive local oscillator injection for the mixer diode. Since the Gunn oscillator functions as both the transmitter and receive local oscillator, the IF receiver at each end of the communications link must be tuned to the same frequency. This means the Gunnplexer might be tuned to 10.255 GHz, and the other station must be tuned to either 10.225 or 10.285 GHz to provide the required 30 MHz IF.

One of the units I operated was calibrated to 10.250 GHz with a tuning voltage of approximately 3 volts. The second unit at 10.280 GHz registered a tuning voltage of approximately seven volts. After approximately five minutes of warm-up, the units held together, rock solid, and seldom was the AFC required.

Horn Antenna

The ARR units are supplied with a plastic 17-dB horn antenna that protrudes from the rear panel of the transceiver. It's an easy job to remote-mount the horn and Gunnplexer from the ARR radio unit. Only three lengths of small RG8X coax cable are needed. The op can put the actual Gunnplexer and antenna system anywhere he wants. Since everything is down-converted to 30 MHz, there's no significant loss in a long coax cable run.

IMPORTANT—NEVER LOOK INTO AN OPERATING HORN. Waves at these frequencies have even higher energy than those used in microwave ovens!

CQ DX

The range between two ARR units is normally limited to line-of-sight. My best DX was 180 miles, between Santa Barbara in Southern California and the Mexican border. Tropospheric ducting plays an important part in over-the-horizon range. Any temperature inversion on a windless day could very well extend the range beyond 200 miles!

Down on the flat lands, as soon as anything got in between two units, communications

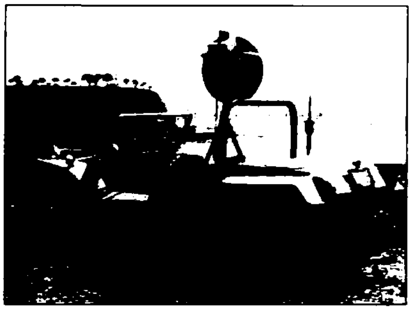


Photo B. X-band mobile.

quit. Foliage is a killer. Buildings sometimes reflect the waves, and sometimes block them. About the best range around a city is a half mile or so. Between two well-elevated towers, however, the range is often 30–40 miles!

I found I could bounce signals off of passing airplanes. This required precise alignment of the set-up, but nonetheless, reflected communications worked nicely.

An op can go about three blocks "on the deck" (ground level) before the absolute non-line-of-sight signal is completely absorbed by houses and trees. Two ops a block apart could probably make contact even through all the stucco and leaves.

Extending Signal Range

Like any good ham, I wanted longer range, so I made some interesting modifications.

I first got rid of the headphones and routed audio to a tiny speaker. There's plenty of audio in the ARR unit to run the speaker at medium volume. Next, I went to a longer feed horn. The new horn was rated at about 26 dB, and it gave me a good boost in signal strength.

Then I went for a 4-foot solid aluminum dish—also available from ARR, but actually manufactured by Anixter Mark in Skokie, Illinois. The 4-foot dish gave a real signal-boosting 38 dB gain. I had to be, however, within two degrees of alignment of the other station, or else all signals were lost. The smaller horns allowed a ±10 degree deviation.

The feed horns are certainly more practical for portable operation and for searching out other signals on the band. While the dish did improve reception slightly, it wasn't as much as the dB figures indicated it would be, so the feed system was sent back to ARR for a checkout.

Long Wait

After 60 days and no returned dish feed assembly, my letters of inquiry to Rusgrove,

Specifications:

Tuning Range:	[illegible]
Power output:	[illegible]
Bandwidth at −3 dB:	[illegible]
Bandwidth at −50 dB:	[illegible]
System noise figure:	12 dB typical
Tuning meter reading for 10.250 GHz:	[illegible]
Tuning meter reading for 10.280 GHz:	[illegible]
Signal level for S9 meter reading:	[illegible]
Audio output:	[illegible]
Supply voltage:	[illegible]
Supply current:	[illegible]
Size:	[illegible]
Weight:	[illegible]

Figure 3. Computing charts for 10 GHz DX.

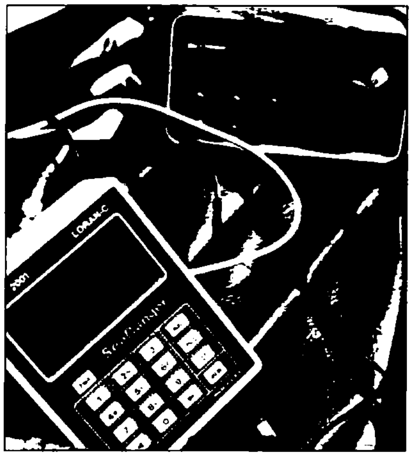


Photo C. Precise pointing between two stations is essential.

owner of ARR, finally elicited a rather terse response: "Since you seem to be unfamiliar with the working of the microwave industry, let me assure you that a 3-month repair schedule is reasonable . . . 26-week or longer time schedules . . ." I finally got the repaired system back, but bear this time factor in mind when returning microwave equipment to the factory for tweaking! It could take a number of months.

Thanks to the high quality of the products, however, most ops will never need to return their gear.

Documentation

The instruction manual accompanying the unit offers excellent documentation on the expected range. All units are computed in dBs. The documentation also includes all the details for tuning and adjusting the equipment, as well as remote mounting the antenna and Gunnplexer assembly.

Scheduling microwave contacts is a must—most microwavers won't get anywhere waving the feedhorn around in the random search for signals. Both system's antennas must be pointed at each other. I suggest coordination on a lower band, such as 2 meters. Generally, if signals are relatively strong between two 2-meter handhelds at either end of the two 10-GHz set-ups, chances are good there'll be full-quieting signals at 10 GHz FM. If the two ops can barely establish hand-held communications on 2 meters, however, chances are they won't make it on 10 GHz.

Tropo Ducting

Most fascinating is the early morning and late evening hours where tropospheric ducting takes place. An inversion layer may trap a 10 GHz signal and carry it for hundreds of miles before another station intercepts it. The record is well over 400 miles, a record which we will attempt to break during this summer's VHF and UHF tropo activity between the California coast and Hawaii.

Those looking for new adventure with quality equipment should turn to 10 GHz and the excellent sets from Advanced Receiver Research.

Number 27 on your Feedback card

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B
3353 Fieldstone Dr.
Doylestown PA 18901

This month's column is somewhat of a hodge-podge. There's correspondence to attend to, some new products to cover, and a few thoughts on summertime VHF/UHF activity. Let's hop to it!

Philippine Hamming

An interesting letter arrived from the hams of the Malaybalay club in the southern Philippine islands: "We have read with interest your article about the IC-2AT . . . most of our club members are using the same model and we find it to be durable, dependable and effective . . . it was only by accident we came across that magazine, since it was very difficult to get a copy of any radio amateur magazine from the USA, much more to subscribe to one . . .

"Our club is composed of thirty members in the municipality of Malaybalay in the province of Bukidon in the southern part of the Philippines. Our club station on 144.380 MHz simplex is a Yaesu FT-211R with 45 watts . . . Our club is assisting the community, most especially the police force since they don't have adequate communications equipment! . . . We are not only using the radio as a hobby, but also as a means to help our community."

The letter goes on to ask if anyone would be interested in donating old amateur radio magazines to their club for a library, no matter how old, to "keep the amateur spirits burning." Kind of puts things in perspective, doesn't it? We have the ability to fire up the 2-meter kilowatt into a stacked array and chase grid squares, while those folks consider themselves lucky to be able to get on FM simplex. Please send donations to: Radio Amateurs of Malaybalay, Inc. c/o Roberto T. Flores, Secretary, 2nd floor Saver's plaza building, 8700 Malaybalay, Bukidon, Philippines.

Neat Stuff

Lots of goodies showed up at Dayton this year, proving that interest in VHF activity is stronger than ever. Antennes Tonna of France introduced three new designs: an 11-element yagi for 220 MHz, a 19-element long boom design with 17.2 dBi claimed gain, and a 25-element yagi for 2304 MHz. The last antenna uses an end-fired horn and 25 parasitic elements, developing 18 dB of gain at 2304 MHz. (Most European 13 cm equipment and antennas are designed with a center frequency of 2320 MHz.) I'll soon review both the 220-19 and 2304-25. They are available from the PX Shack in Belle Mead, NJ.

PC Electronics of Arcadia, CA, introduced at Dayton their new TX23 ATV transmitter for 1240–1300 MHz. It's similar in appearance to other PC models and develops 1 watt PEP output with a 4.5 MHz sound subcarrier. They supply a crystal for the 1289.25 MHz standard ATV simplex frequency, and other crystals are available. Input connection allow interfacing with just about any camera or video/audio source. It's quite a package for $299.

For the ever-expanding 33 cm crowd, VHF Communications of Jamestown, NY, introduced the complete 902 linear transverter. It takes up to +10 dBm input (or up to thirty watts with the optional attenuator) and develops two watts output. The optional amplifier (in kit form) boosts the signal to 20 watts. The basic transverter runs about $400.

Transverters Unlimited showed a new improved version of their SLA-13 13 cm amplifier which uses a Teflon™ PC board and a pair of ON4284 devices to develop 10 watts of true class AB linear power with 1.5 watts of drive. For $299, it's hard to beat.

> ***"For the ever-expanding 33 cm crowd, VHF Communications of Jamestown, NY introduced the complete 902 linear transverter."***

RF Concepts introduced a new line of 70 cm all-mode amplifiers, running 100 watts output with either 10 or 30 watts of drive. They include a 15-dB GaAsFET preamp. The RFC 4-110 and 4-310 price out at $324 and $349 respectively. RF Concepts also showed a nifty repeater controller, called the 8-RC. It is a big shift away form the bells and whistles, focussing instead on multi-tasking capabilities, including not only a repeater but several remote sites and and voting circuits. The suggested list is $395.

Telex/Hy-Gain showed off their new 215-DX 15-element 144 MHz long yagi. How well does it work? Well enough to win the antenna gain contest at the Hamvention measuring 14.3 dBd. The boom length is 28 feet, similar to the Cushcraft 42-18XL. Great to see Hy-Gain back on VHF and UHF as well, with the 7031-DX for 70 cm fans. It finished second on the antenna range with 16.5 dBd.

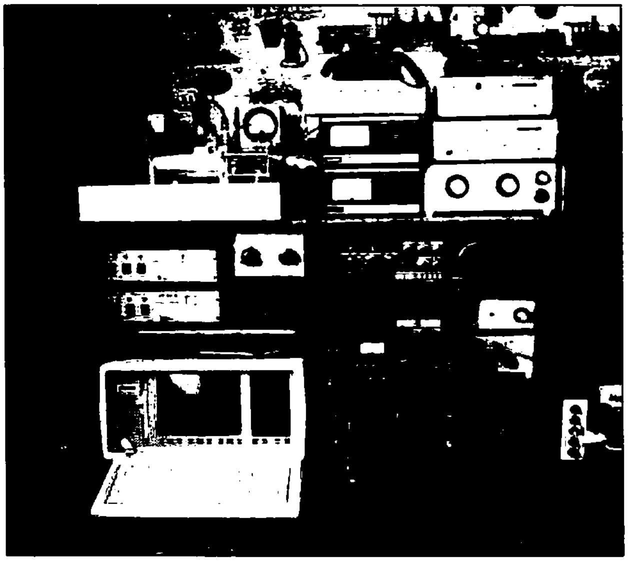


Photo A. A view of the station at KT2B. Output is 100 watts on every band except 903 MHz (25W) and 2304 MHz (2W). An Amqute PC is used for logging and duping during contests, as well as word processing and preparing this column!

Newsletters

Two publications VHF/UHF fans should add to their monthly mailbag: The *Midwest VHF Report* and *VHF/UHF and Above Information Exchange*. Roger Cox WBØDGF edits the first. I've quoted extensively from the *Midwest VHF Report*. It contains a wealth of information about VHF, UHF and microwave activities in the Midwest and Southwest. *The Report* is produced on an Apple Macintosh and runs only $10/year for a subscription. Write to: Midwest VHF Report, 3451 Dudley St., Lincoln NE 68503-2034.

Rusty Landes KAØHPK edits the *VHF/UHF and Above Information Exchange*. It covers all aspects of VHF operations, including moonbounce (with the 432 and up EME News) and extensive grid square standings. Subscriptions for this monthly run $16.50/year bulk rate or $21/year first class. Write to: VHF/UHF and Above, PO Box 126, St. Mary of the Woods IN 47876.

Sprints

The ARRL Spring Sprints were a flurry of activity. Most of the sprints were well-attended, especially those for 432 and above. The 2304 Sprint (its first running!) had a lot of activity. Many such stations here in Pennsylvania fired up and made contacts. (I participated in this, though my station suffered from an oscillation problem, which kept me from hearing other stations.)

Some VHF operators discussed moving the microwave (i.e 902 and above) sprints to the fall. Tropo conditions are generally nonexistent in May, and frequent thunderstorms and rain make mountaintopping unpleasant! I suggest moving this event to late September/early October when conditions are peaking and the weather is favorable. Send in opinions on this!

Conventions

The biggest of all the VHF/UHF conventions is the annual gathering of members (and friends) of the Central States VHF Society. This year's meet took place 21–24 July at the Villager Motor Inn,

5200 "O" St., Lincoln, Nebraska. There were tours of Hy-gain, and antenna gain/preamp measuring events.

Microwave Update '88 will take place 25–28 August at The Inn At Estes Park. There will be papers on phase-locked oscillators, antenna feeds, microwave cavity amplifiers, transverters, lasers, and filter design. Don Hilliard WØPW is the coordinator. The conference is pre-registration only—no drop-ins. Conference rates are $32 before 15 June, and $40 from 16 June to 1 August. Room rates are $46/night. Write to Don at PO Box 563 Boulder CO 80306.

Contests

By this printing, the CQ VHF WPX will have come and gone, no doubt bringing the usual hot weather and numerous grid DX-peditions. The low power categories are becoming very popular in this contest. My plans were to activate both KT2B/2 in FN24 and KT2B/VE3 in FN14 with low-power equipment on 6, 2, 220, 432, 903, and 1296. The readers will have to wait until October to find out how it all went! In the meantime, why not pack up some gear and go portable for the ARRL August UHF Contest? It's the first full weekend of the month, and the contest period is only 24 hours . . . plenty long enough for tropo, but short enough for a weekend jaunt. I'll be checking in from Cathead Mountain, NY, in FN23 on 432, 903, 1296, and 2304 MHz.

> ***"Most of the sprints were well-attended, especially those for 432 and above."***

Help!

The October Issue of *73* will be devoted to microwave operation. . .that is, activity on the bands on and above 900 MHz. Readers who have appropriate articles need to submit them to the magazine before 1 August. *Get schematics and other graphics in as soon as possible!*

I'm compiling a list of manufacturers of equipment, antennas, and kits, which will appear much the same as the Hand-held Directory from December 1987. If your company has an amateur microwave product—transverters, amplifiers, surplus items, test equipment—I want to hear from you! Mail this material to me no later than 29 July, at the above address. Interest in centimeter- and millimeter-wave operation is definitely on the upswing, as shown by the Sprints and and the January VHF Sweepstakes results.

Sources

Anyone who spends any time installing and removing antennas knows the value of using stainless steel hardware and brackets. Now there's a fairly inexpensive source for just about any stainless steel hardware including U-clamps and nuts. The company is Jacob Schmidt and Son, located at 1908 Sumneytown Pike, Harleysville PA 19438, (215) 234-4641. Their recent catalog shows such stainless items as U-bolts and keepers, screws, lag bolts, socket screws, hex head hardware, wing nuts, hex nuts, set screws, cotter pins, washers, tubing, and much more. Write for their catalog!

Steve Kostro N2CEI is a good source for all kinds of VHF goodies, including some dirt-cheap preamp kits for 28–2304 MHz, at $30 each. Among his wares are MMICs, GaAsFETs, voltage regulators, chip capacitors, helical filters, piston trimmers, diodes, SMA connectors, toroids, and Teflon™ PC board material. He also carries one-of-a-kind items such as filters, mixers, splitters, power amplifiers, and connectors. His address is Box 341A, RD1, Frenchtown NJ 08825. He can be reached at (201) 834-1304 from 9 a.m. to 7 p.m., and at (201) 996-3584 from 9–11 p.m.

Finally, Bob Seydler N5KET of Rt. 2 Box 2170, Boerne TX 78006 published a small catalog of all kinds of surplus microwave equipment, including transmitters, receivers, oscillators, isolators, circulators, and power amplifiers for 1 GHz and up. Some of these active devices work, and some don't, but all are clearly labelled. He also has a sizeable stock of connectors, GaAsFETs, microwave diodes, and attenuators. I bought four of the 2304 isolators which are ideal between solid-state gain blocks where 50Ω impedance matches are sometimes hard to achieve.

That's it for this month. See you next month with a complete write-up on our June DXpedition to Chincoteague Island!

10 AND 75 METER CONTEST RESULTS

10 Meter World Championship—Contest Results

Single Operator:

Callsign	OTH	QSO's	St/Prov	DX	Score
KD8AQ	FL	549	39	1	107,250**
AA4LE	AL	537	36	0	96,660*
K1NYK	CT	525	32	3	92,050*
N3II	MD	386	40	5	87,300*
NØCDH	MO	348	40	3	75,035*
VE3FWO	ONT	331	35	3	62,890*
K9JS	IN	257	37	3	51,000*
K9ZO	AL	291	35	0	50,925
KS4S	NC	268	37	1	50,920*
KJ4NN	KY	333	25	3	46,620*
NE9O	IN	241	36	2	45,790
WD4KXB	VA	214	38	2	42,800*
N4HQT	TN	306	25	2	41,580*
ADØO	CO	214	35	3	40,660*
K3TX	PA	252	31	1	40,320*
KA5PGA	AR	254	23	2	31,850*
W3HXI	MD	206	26	4	31,500
AC3T	DE	201	29	2	31,155*
W4WKO	FL	213	28	0	29,820*
KT3U	PA	182	30	1	27,450
K2OLG	NJ	144	34	3	26,825*
WØEJ	IA	171	29	1	25,800*
NF9R	WI	161	31	0	24,955*
N8CXX	MI	151	27	2	22,185*
WB8MDG	MI	155	27	1	21,840
KVØI	NE	139	27	2	20,010*
W6MKB	CA	135	13	9	18,370*
KD7UF	NJ	99	31	2	16,335
WB5SSD	LA	154	21	0	16,170*
VE1TE	NB	101	32	0	16,160*
K8HVT/1	CT	115	25	2	15,660
K3YDX	MD	94	25	2	12,960
KA1MXZ	CT	80	24	1	10,125
NØFZR	IA	102	19	1	9,265
NR5O	FL	85	20	0	8,500
KJ4WH	FL	86	19	0	8,170
KI4UJ	KY	64	24	1	8,000
N4GTU/5	TX	49	20	2	5,610
WA5IYX	TX	53	20	1	5,565
KD9OY	WI	49	19	1	5,000
KAØVYM	MD	46	18	1	4,370
N5AFV	TX	44	15	1	3,520
KC3XD	PA	39	17	1	3,510
N5IET	TX	33	17	1	3,060
W9HOT	IL	29	15	0	2,175
KAØQOP	IA	33	12	1	2,145
WA6FGV	CA	32	6	4	2,000
K9OCU	MO	25	12	1	1,625
KC3ZG	PA	23	9	1	1,150
VE3IR	ONT	18	12	0	1,080
WB2TKD	NY	14	8	1	630
W1LUG/4	MA	9	4	1	250
WBØYJT	KS	7	6	0	210
WA3JXW	PA	6	3	0	90
KF1B	CT	1	1	0	5

Multi-Operator:

N43JV	FL	941	44	3	219,255**
KB4RXM	TN	623	42	6	151,920*
K5LZO	TX	572	43	7	137,000*
N2EOC	NJ	532	40	4	117,260*
KA5DLM	LA	431	35	2	79,735*
N4EOS	CA	79	17	1	5,525
WV2ZOW	NJ	29	16	1	2,465

DX Stations:Single Operator:

VP9AD	Bermuda	1487	45	10	411,675**
XE1L	Mexico	91	17	6	11,960
HK3MAE	Colombia	43	10	8	6,930
CO2CB	Cuba	41	14	1	3,150
JE1SLP	Japan	80	0	3	440
JH1UUT	Japan	17	0	2	190
JE7HFQ	Japan	10	0	1	50
JI3BFG	Japan	6	0	1	30

Multi-Operator:

JA9YBA	Japan	1	0	0	5

Multi Operator Station Participants–

N2EOC	N2EOC and N2CEI
WV2ZOW	WV2ZOW and WB2TIX
N4EJV	N4EJV and N4EJW
N4EOS	N4EQS and N6HC
KB4RXM	KB4RXM and N4JII
KA5DLM	KA5DLM, N5JBZ, KB5ACJ, N5JWA, and KD5RW
K5LZO	K5LZO, KE5IV, NM5M, WB5N, N5VF, and WB5RUS
JA9YBA	JA9VDA and JA9-10148

10 Meter Honor Roll–All Time Record Holders–

	Category	Call	Year	Score
Single Operator:	USA	KD8AO		107,250
	Canada	VE3FWQ	87	62,890
	DX	VP9AD	87	411,675
Multi Operator:	USA	N4EJV	87	219,255

75 Meter World Championship—Contest Results

W/VE Single Operator:

Callsign	QTH	QSO's	St/Prov	DX	Score
KO3V	PA	641	58	38	336,960**
KE5FI	TX	680	56	37	332,940*
K5ZD	MA	651	55	37	329,360*
KØHA	NE	795	58	18	309,700*
WB2ULI	NJ	412	53	43	242,880*
KC8P	MI	555	58	16	214,230*
ADØU	CO	613	54	14	211,480*
N8CXX	MI	570	59	13	207,360
KVØI	NE	594	58	6	191,040
KI4DC	KY	477	55	13	163,540*
NC9F	IL	457	56	12	160,140*
WB7OJV	WA	446	52	10	138,260*
NE9O	IN	445	50	9	132,455*
W4TME	NC	384	54	11	125,125*
KS7T	MT	352	51	16	122,610*
W4WKO	FL	390	51	6	112,290*
VE5RA	SASK	323	53	10	102,060*
AA4LE	AL	327	52	5	94,050*
K4ADI	SC	326	50	3	86,655*
N4HQT	TN	323	47	0	75,905*
K3TX	MI	301	40	4	66,220
KI3L	NM	229	48	8	64,960*
KA7DLV	MN	251	49	1	63,000*
NR4S	TN	212	47	6	58,300
WB5SSD	LA	214	47	5	56,680*
WA6FGV	CA	235	47	3	56,640*
K4GKV	GA	218	43	7	55,500*
KMØL	MO	200	45	1	46,000*
KC1BG	MA	128	46	4	32,250
KA2OSV	NJ	162	36	0	29,160
KA1PA	MA	103	41	6	24,440
KA8ZDF	MI	139	35	0	24,325
NØCLV	KS	105	40	1	21,525*
WA3EZN	OH	102	36	1	19,055*
WBØBJP	MN	90	37	4	18,660
WA1UJU	WI	106	35	0	18,550*
WB2EKP	NY	111	31	1	17,660*
W4UYC	GA	85	36	3	16,770
N8AXA	OH	72	40	3	15,695
WK4F	FL	73	34	7	15,170
W4XT	KY	66	34	2	11,880
WB9SAU	WI	64	36	1	11,840
KB9MS	IL	65	34	2	11,700
KT2D	NJ	101	20	0	10,100
WØCEM	KS	74	26	0	9,620
N9EOM	IL	63	28	4	9,600
WB8YEW	OH	5F7	29	1	8,550
W9REC	IL	62	26	0	8,060
KD9OY	WI	51	31	0	7,905
NA8W	OH	48	27	2	7,540
K8GSR	MI	48	29	0	6,960
KE8IR	MI	48	28	0	6,720
KC3XD	PA	49	26	0	6,370
WA5IYX	TX	44	25	2	5,940
KB1XD	CT	38	20	5	5,250
KE7QA	UT	43	22	0	4,730
KA3OGY	MD	34	20	0	3,400
N5AFV	TX	28	21	0	2,940
KC3ZG	PA	19	16	0	1,520
W1LUG	VA	19	12	0	1,140
KF1B	CT	17	11	0	935
KØJVZ	CO	8	7	0	280

* State, provincial, or DX Country Champion

** World Champion

Multi Operator:

K2PM	NJ	1310	59	56	890,100**
W7MR	UT	689	57	16	257,325*
KS3F	PA	698	57	14	249,920*
KB9S	WI	640	56	12	219,300*
NK7U	OR	553	57	14	200,575*
KB4RXM	TN	608	54	4	177,480*
WA5VVT	AR	437	53	10	140,775*
WD9INF	OH	367	55	9	116,440*
KA5DLM	LA	337	51	5	95,200*

DX Single Operator:

NP4P	Puerto Rico	669	55	49	428,480**
HI8RKM	Dominican Republic	373	49	30	165,900*
CO2CB	Cuba	305	54	5	90,565*
8P9AY	Barbados	156	38	25	61,740*
OZ1DPW	Denmark	6	2	4	300

Multi Operator:

JA9YBA	Japan	2	2	0	40

Multi Operator Participants

K2PM	K2PM and K2NJ
KS3F	KS3F, NE3F, and KC3RY
KB4RXM	KB4RXM and N4JII
KA5DLM	KA5DLM, KD5RW, N5JBZ, and KB5ACJ
WA5VVT	WA5VVT, WB5GFA, WD5BZO, and KB5BRI
W7MR	W7MR, N7IDG, KE7ST, KE7RU, and N7IEM
NK7U	NK7U, NI7T, and KE7OC
WD9INF	WD9INF and K9EC
KB9S	KB9S and KIØF

Continued from page 23
from Jameco. BCD Electro[4] is another good source of many of the parts. The circuit is relatively simple. The builder can breadboard it with point-to-point wiring.

Since I received so many requests, I made a printed circuit board available. The PC board is configured to plug directly into the cassette port, and all power comes from this port. (To obtain the −5 VDC, use an ICL7660 voltage inverter chip.) As an alternative, use a 6-conductor cable to mount the unit remotely. Both mountings that use the PC board eliminate the need for an external power supply. Complete parts kits and assembled units containing the watchdog timer and reed relay output options (both containing cassette port connectors and the PC board) are also available.[5]

If breadboarded, the power supply has many options. Several hams have used wall transformers from old video games or toys. (Jameco has several available, for example, part #DC512. It is a wall transformer with DC outputs at +5 V, −5 V, and +12 V.) Make sure the transformer's output is DC, not AC! Adding a 100 microfarad capacitor across the output will provide better filtering and regulation.

Another option to power the circuit is the +5 VDC from the C64. The C64's power supply has a limited reserve, however, so, if used to power the modem, don't connect other devices to the accessory or cartridge ports.

Overall, the AM7910 interface should cost less than $50 in parts, assuming no junk box parts. Not bad to get on packet!

Software

As with any packet system, there is a command mode and a converse mode. Digicom>64 recognizes a colon (:) as the first character of all commands. Any line not beginning with a colon is transmitted. Commands may be abbreviated to the least number of characters that make it unique. For example, this is the command string to connect to me via the WD3IGI digipeater:

:C W2UP V WD3IGI (carriage return)

Several parameters must be set prior to initial operation. While most parameters have default values, users will probably want to set many of them for their personal preferences (for example, screen color, 40 or 80 character screen, etc.). On the disk, I have included a "PERM file" that boots with the program. It's set for VHF operation at 1200 baud, while using 60 Hz AC. One parameter the user needs to set is MYCALL, which enters his callsign, and is transmitted in every packet. The system won't allow transmissions when this isn't set. It's set individually for each user port as follows:

:MYCALL W3XYZ (carriage return)

Full documentation is contained on the program disk.

Hardware

The modem requires connections to the receiver's audio output, the transmitter's microphone (or accessory audio) input, the PTT line, and ground. All connections to the computer are via the cassette port. Once this is done, it's a simple matter of selecting the correct mode of operation. Experiment with the Equalize mode on VHF to determine whether or not it's needed. Once that is done, just flick on the switch and it's ready to go!

LEDs show POWER and DATA. Whenever packet data is received (whether intended for that station or not), the DATA LED will lights. It's purely for show, and is optional.

Final Comments

As of early 1988, I have sent out to five continents about 900 copies of Digicom>64 with associated circuit diagrams. A warning: I have heard rumors that both the software and interface diagrams have appeared on some "commercial" telephone access bulletin board services with incorrect information.

Before initial testing, recheck the wiring and make sure there are no solder bridges between connections. NEVER plug or unplug the cassette port connector with power applied to either the computer or modem.

This project provides an inexpensive and easy way to join the many hams already on packet. It also gives the builder a sense of accomplishment and the satisfaction of "rolling his own."

I would like to thank the authors of Digicom>64, DL2MDL, DL3RDB, and DL8MBT for writing such a superb program, and releasing it into the public domain. I thank Frank DL1SBR for providing the English translation of the documentation.

Willy YV1AQE provided the basic AM7910 circuit, which I have modified. I also thank the many hams to whom I have sent copies of the program over the last year, and who provided me with valuable feedback and tips concerning both the software and the interface, which have culminated in this article. ■

Notes

[1] *QST*, November 1987, p. 59. *Gateway*, 3:22, p. 2.

[2] Software is available from me on 5 ¼-inch floppy disk for $6. This includes shipping and handling. Please include a self addressed mailing label. The disk inlcudes the Digicom>64 program and documentation files.

[3]. Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002. Phone (415) 592-2503.

[4]. BCD Electro, PO Box 830119, Richardson TX 75083-0119. Phone (800) 456-2233 or (214) 343-1770.

[5]. The following parts and kits are available from me:

Blank PC board	$10.65
Blank PC board with disk	$14.95
Kit of parts with PCB and disk	$49.95
Assembled/tested PCB and disk	$79.95
Shipping and handling (US only):	
Orders less than $50	$2.50
Orders greater than $50	$3.50

For orders outside the US, please inquire for shipping charges. For all inquiries, please include an SASE.

QRP

Number 29 on your Feedback card

Low Power Operation

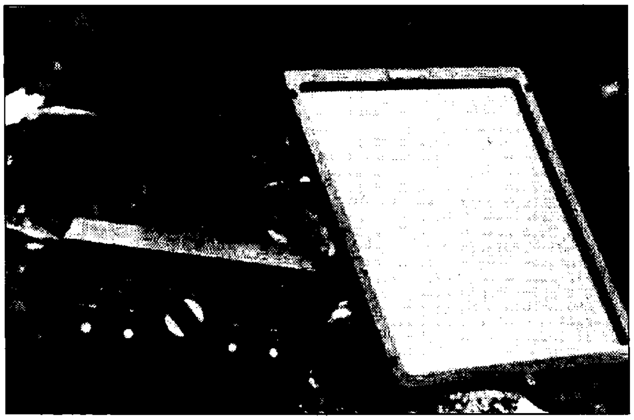


Photo A. This small five watt panel will supply all the power needed for the HW-9.

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Solar Energy—Background in Brief

The process of producing electricity from sunlight is called Photovoltaics, or simply PV. The phenomenon was first observed in 1839 by French physicist Edmond Becquerel. In 1905, Albert Einstein explained the photoelectric effect and, since the 1950s, PV has gained widespread use. Today, solar generated electricity is used throughout the world for water pumping, refrigeration, communications, lighting, and virtually any use requiring electricity. During the past several years, the thin film PV panel has made low cost solar electricity quite common. Chances are you may even use a solar calculator or wear a solar powered watch.

Light consists of trillions of invisible particle-like photons. These are best described as tiny bundles of energy. When a cell (usually made of silicon) is exposed to sunlight, the photons release their energy to electrons within the cell. The charged electrons are then collected on the surface of the cell. A wire is soldered to the top of the cell. This becomes the negative lead. After the flow of electrons pass through a load, the electrons lose their energy and return to the bottom of the cell via a second wire lead. Following this process, the electrons are ready to pick up more energy from the photons. As a result, the electrons themselves are never physically "used up."

Photovoltaics received widespread use and acceptance beginning in the late '50s, with the advent of the space program. As a lightweight and highly reliable power source, photovoltaics rapidly found a niche in space applications.

Of course, this is a very simple explanation of the photovoltaic (PV) effect. Reams of paper have been filled explaining the hows and whys of PV. "Sunlight in, electricity out," however, is all we really need to know here.

Each cell, regardless of size, generates about 0.5 volt of electricity. Amperage increases with the intensity of the light and the surface area of the cell. Cells are connected to form modules and modules are connected together to form arrays. Depending on the end use, modules are normally wired with 36 cells in series. This produces a module with a open circuit voltage of about 20 volts. This will load down to roughly 14 to 15.6 volts when connected to a battery.

Standard wattage for PV modules is 35 watts. Smaller and larger modules are also produced.

Amorphous Silicon PVs

Up to now, almost all solar cells were made of crystalline silicon, the most common element on the planet. The silicon had to be melted, refined, and melted again. Converting sand to semiconductor-grade silicon is an expensive process.

The introduction of amorphous silicon thin film photovoltaics, however, has sharply dropped prices. Amorphous silicon has no defined crystal structure—the molecules are arranged haphazardly. This lack of order makes their properties extremely difficult to analyze mathematically. Glass, and some hard candies, are examples of substances with amorphous structures. Amorphous silicon materials are far easier to make: The ingredients need only be melted together in a crucible. Each atom is free to bond to any other it happens to find itself near. The number of possible combinations in amorphous materials is practically unlimited.

By adding a little of this and some of that in the right mixture, we have a ovonic device, or semiconducting glass. The term ovonic is derived from Stanford Ovshinsky, the forerunner in amorphous technology. Stanford Ovshinsky formed Energy Conversion Devices Inc. Sovonics, a wholly owned company of ECD, produces thin film photovoltaics.

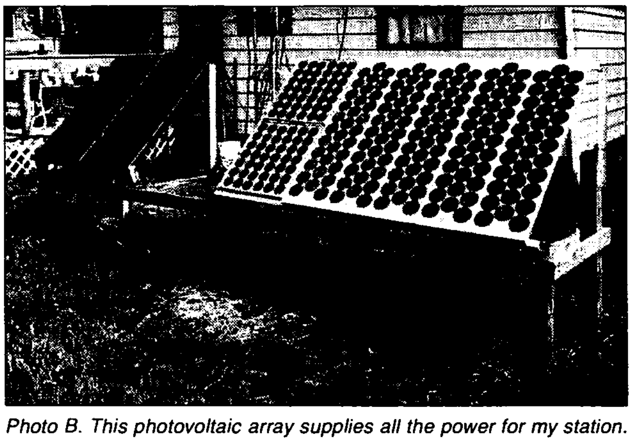


Photo B. This photovoltaic array supplies all the power for my station. This includes 24 hour packet repeater and lighting for the shack.

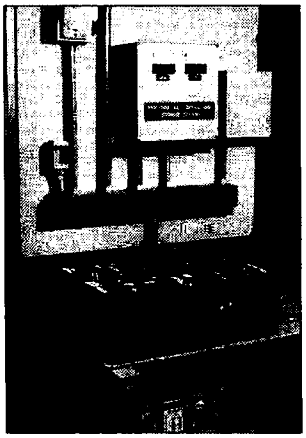


Photo C. Control system that resides in the basement of the house. All energy from the photovoltaic array and wind mill is stored here.

Sovonics produces high performance tandem solar cells on flexible stainless steel and covers them with Tedlar™.

This high volume manufacturing process is the ultimate in solar cell production technology. Sovonics mass-produces solar cells in a process similar to how newsprint is produced, called continuous roll-to-roll deposition. The process produces the largest solar cell in the world—a 35-pound roll that will produce 40 kW. The active cell total thickness is about 1.100 of the thickness of one human hair!

Since Sovonics uses a substrate of stainless steel, you can bend, drop, twist, and generally rough-up these panels and they'll still work. They're light-weight and non-breakable. If it sounds like I'm impressed with Sovonics, you're right! There are others who also manufacture thin-film photovoltaics. Among those: Arco, Solarex, and Chronar. These companies chose to use glass as a substrate instead of stainless steel.

Take a Look

Photo A is a good example of solar energy at work. A five-watt Arco Genesis thin-film panel charges up a gel-cell battery to operate the HW-9. I used this set-up for several Field Days and have had great results.

Photo B is the PV array that stands in the back yard for home operations. There are three different types of photovoltaic panels shown: Arco, Solarex, and Sovonic. This array produces a peak power of 200 watts. I plan to upgrade the entire array later on this

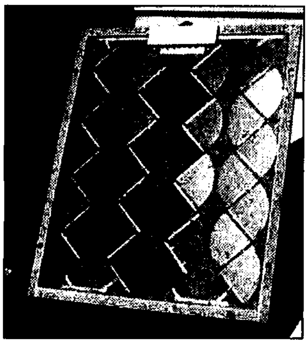


Photo D. Small three watt photovoltaic for the QRP operator. Would supply quite a bit of power.

summer to 500 peak watts.

Photo D shows a small two watt module. This module was made by Solarex. It uses crystalline silicon cells in quarter disks. The module shown in Photo E produces a bit more power–it is a 12 watt Sovonics Sun Flex unit.

How To Use a PV Cell

The user must not connect a photovoltaic module directly to any electronic device—the unregulated voltage may well destroy a unit it's meant to power. Use either a battery or a voltage regulator. The battery serves as both a regulator and storage device. I will discuss batteries in greater detail in a future column.

While smaller PV modules can safely connect directly to a battery, it's generally a good idea to protect the battery from overcharging. When large arrays with days of battery storage are included, the control system can get quite involved. Photograph C is the control and energy storage system I use in my home. Since this photograph was taken I have added more metering.

Additional batteries were also placed in service. The batteries on the top shelf are Exide EV-IVs rated at 220 amp-hours at a 20 hour rate. There are twelve of these in my system now. The batteries located on the bottom shelf are for portable and emergency use. The three 105 amp-hour deep-cycle Exide SP-015s and two 60 amp-hour torque starters are charged by an energy dump. The control system will first charge the main batteries (top level). When the batteries are fully charged, the controller will float them at the proper voltage, with the majority of the current going to the bottom batteries.

The controller inside the smaller enclosure is the heart of my solar storage system. The controller is a two-step regulator—it switches back and forth between constant current and constant voltage modes. The terminal voltage of the battery bank instructs the controller when to switch. There are, of course, other ways to determine the state-of-charge of a lead-acid battery. Terminal voltage is perhaps the most common. No one as yet invented a fuel gauge for batteries.

Go Solar!

Photovoltaic electricity is rapidly becoming the technology of choice for powering amateur radio stations. Power reliability is essential to emergency communications. More times than not, commercial power is not available during a disaster. Sometimes it is necessary to carry communications equipment by hand into disaster areas. This man-portable set-up also requires light-weight power generation. Photovoltaic energy fills the bill nicely, as sure and silent as the sun.

Hook up to the sun! Charge those batteries with sunlight using photovoltaic modules. Electricity produced from sunlight is a silent, non-polluting, and non-rotating source of energy. I will soon show in more detail the finer points of running a station from the sun's rays.

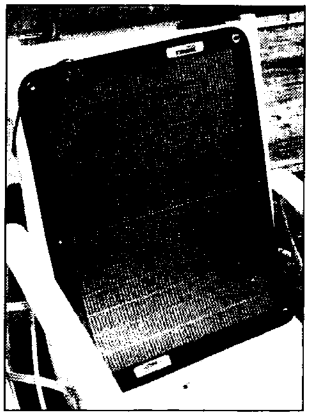


Photo E. A larger 12 watt Sovonic thin film module.

Next month's QRP column will look at antennas. I'll have some new ones to put up along with a second look at the vertical antenna. It is going to be a "don't miss" issue.

I'm still looking for Field Day photographs. As always, this column is for the QRP operator. Those who want bragging rights must send in their photos! 73

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

Definitive Coordination Recognition?

There was another surprise for FMers and repeater owners at Dayton Hamvention '88 in addition to the unexpected appearance and talk by former FCC Special Services Division Chief Raymond A. Kowalski. This one took place a day later at the FCC Forum on Sunday, May 1. ARRL Hudson Division Director Steve Mendelsohn WA2DHF and Rocky Mountain Division Director Marshall Quiat AG0X brought the League into the middle of the national coordination mess. The two directors conferred before the FCC forum and realized that affirmative action was needed to end the repeater coordination debacle—the one created by the FCC now sweeping the land.

It was about half way through the question/answer session when Director Mendelsohn requested the microphone. The following exchange ensued between WA2DHF and FCC Personal Radio Branch Chief John B. Johnston W3BE:

Mendelsohn: "(Suppose) the League undertook a national referendum—writing to every repeater trustee listed in our database—and asked them if if they support their local repeater council as it currently exists? In the case where the majority of responses support a given local repeater council on this independent referendum, and we (the ARRL) certified to you that that given council has the majority support in their area, would you then recognize and work with those councils?"

Johnston: "I would think so, because we are trying to use your Repeater Directory now, even with the disclaimer..."

Mendelsohn (interrupting): "Hold on. I didn't say anything about the Repeater Directory! I said that we, the League, will undertake a third-party referendum! We will do the mailing! We will do your footwork to find out who is and isn't supported! We will then certify to you the following people by whom the following majorities are supported. Will you then recognize those councils?"

Johnston: "I think there's a good chance we would consider it..."

With the FCC's hesitant receptiveness to Director Mendelsohn's proposal, it now must be brought before the ARRL Board of Directors for their stamp of approval. The votes needed to pass it likely exist, as the League would never have opened it to the public. They will be meeting at the time this column appears, so watch the ham newsletters and listen to the bulletin updates for news of the Board's action.

How will such a vote be handled and certified? The following is only my hypothesis. The ARRL already has the needed machinery and personnel in place. Every year the ARRL runs elections for its Directors, Vice Directors and Section Managers. They use the highly prestigious outside accounting firm (Price-Waterhouse) to supervise the Committee of Tellers from the ARRL in the vote tallying. This adds much credibility to the process.

The same tamper-proof, though highly expensive system, might be used where working with a Committee of Tellers from the ARRL Board of Directors assembles in a real-time supervised basis to open and count each vote in an election. In the case of their political elections, the results are certified to the membership—in the case of this proposed repeater coordination referendum, the outcome of the voting would be certified to the FCC. Using the same committee to do both jobs could save much time and money.

Questions

There are questions that still need answers: Will all coordinators agree to such a vote? Only the long-established groups, after all, have anything to gain. The so-called new "instant coordinators" may decline because to lose the election means giving up their coordinating ego-trip. Why should an instant coordinator accept this method, since it will probably mean an end to his activities?

How far to extend the franchise? Currently it's set up for the repeater-owners only. The sheer cost of the process is the limiting factor. The cost of having some 10,000 or more repeater owners vote for their favorite coordinator might run the ARRL into tens of thousands of dollars, and this is with the electoral machinery already in place. Imagine the cost to have every ham in the nation cast a ballot on this measure? Yet, according to the December Kowalski letter, even repeater users can be held liable for interference. Is it not unfair, then, to exclude this group from the franchise?

Finally, how binding will it be? The ARRL implied that this referendum could be a one-shot affair, not an annual event. Once this election takes place, the names selected by individuals and groups will be cast in concrete. Yet how will this stand up to a court challenge?

More On Ray Kowalski

Last month's column dealt with former FCC Special Services Division Chief Ray Kowalski's surprise appearance and talk at the Third Annual National Frequency Coordination Conference at Dayton Hamvention '88. This section continues giving excerpts of that talk.

It's interesting to note the difference of opinion between repeater coordinators (and now obviously the ARRL, as noted above) and the former FCC Division Chief. They generally believe it's only the repeater owners who should have any say in the coordination process. Kowalski definitely disagrees:

"...you can't give franchise to repeater owners and disenfranchise every Tech and above ham who doesn't own a repeater. A repeater owner does not necessarily have to have his amateur license. Thus, in this solely ham-related issue, it's possible for a non-ham to have a vote in a strictly ham related issue, and for a ham not to! Some fresh thinking is needed here."

Kowalski then turned to a topic on the mind of everyone seated in the very crowded room:

"...I suppose when many of you heard that I was going to be here today you thought I was going to defend my infamous letter of last December. (The letter of regulatory interpretation that permits more then one coordinator to function in the same geographic area at the same time.)

"...That letter...is an absolutely asinine outcome. It puts people in a totally ridiculous position. To say that there could be two repeater coordinators in any geographic area is absurd!!!

"I would reach the same result today, however, under the same circumstances. I'm not sure how you fix it. I have...some suggestions.

"The letter tries to appeal to the coordinators' sense of compassion to their users as a way to get them to resolve their differences—or even compel the users to pressure the conflicting bodies to resolve their differences. We said that if you dual-coordinators don't want to expose your users to the potential for some enforcement stemming their coordinated versus non-coordinated status, you guys will get together and share your information so that you do not have inconsistent positions. That of course makes two repeater coordinators into one.

"The general body of repeater users, (however), whom that language was designed to protect doesn't know about it and could care less. Someone was telling me yesterday that, 'As long as the repeater kerchunks when they hit the key, that's all they (the users) care about.' Well, maybe you have got to get a little better grassroots support and understanding among the people who use these things and get them to realize that it's not just the repeater coordinators who have to carry all of the weight here. (Let them know) that there's some real (legal) exposure for the repeater users..."

Ray next commented on the FCC. "The Commission isn't going to conduct a fact-finding hearing to determine who is a legitimate coordinator. That's exactly what would have been called for in the situation last December (in reference to the 220-SMA vs. 220-FCC case in California, and the MoKan Council of Amateur Radio Clubs vs. the Missouri and Kansas Coordination Councils in the Mid-West). In order to reach a determination on who was the rightful coordinator, the Commission would have had to go into an investigation that they can't afford!

"I checked this out the last time I was there...the enforcement list...was two and a half pages long. (There are) only three people writing regulations. One person does enforcement. One person does rule making. The third splits his time between the two. That's it!"

To be continued... 73

73 INTERNATIONAL

edited by Richard Phenix

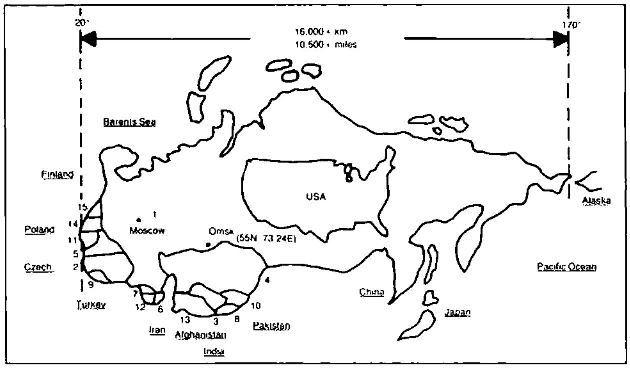


Figure 1. The USSR, location, relative size, and populations by Republics in order of size (in millions). 1—Russia (145.3); 2—Ukraine (51.2); 3—Uzbekistan (19); 4—Kazakhstan (16.2); 5—Byelorussia (10.1); 6—Azerbaijan (6.8); 7—Georgia (5.3); 8—Tadzhikistan (4.8); 9—Moldavia 2(4.2); 10—Kirghizia (4.1); 11—Lithuania (3.6); 12—Armenia (3.4); 13—Turkmenistan (3.4); 14—Latvia (2.6); 15—Estonia (1.6).

WELCOME TO THE USSR

We are pleased to bring you this first (brief) report from our Russian correspondent, Gennady Kolmakov UA9MA. Others will follow in the coming months.

No doubt this opening of communications with the USSR through the pages of *73 Amateur Radio* will inspire some of you to write to UA9MA, to request information, share information, or just to chat. Before you do, **please read this page and the boxed information carefully!**

The information here will remind you (or help you to understand) that one volunteer ham, in the middle of the largest nation in the world (8,650,000 square miles), with a population of 280,000,000 in 15 different Republics and including 104 different national groups speaking 70 different languages, will not be able to answer either all questions or all letters! (Write him in Russian, if you must write, and, of course, enclose IRCs.)

We don't want to load too much on him—and lose him—we can show him thoughtful consideration best if you will send your letters through us, care of this column. We can combine requests for information, translate them into Russian if necessary, and airmail them. (Your name, call, address, and IRCs can also be sent—if you wish—so that he will have the option of replying direct to you if he wants to.)

USSR

Gennady Kolmakov UA9MA
PO Box 341
Omsk - 99
USSR

I was very happy to receive the 1-year subscription to *73 Amateur Radio*!

Recently I came back from a Moscow radio conference (9–10 April) where we discussed many problems and questions at great length.

1. Now we can send and receive direct mailing.
2. We can print our addresses and personal picture on QSL cards.
3. We can publish our addresses in any Call Books (and also probably publish new USSR Call Book for the 88–89 Year).
4. We can QSO with 4Z4, 4X4 Israel stations (after [not doing so since] 1967). . . .
5. And many other questions which are shown in the newspaper article. [*See box for translated excerpts—Ed.*]

I will try to give you information which you ask in my next letters.

Many thanks! 73.

P.S. I am QSL Manager for UV1OO Franz Joseph Land DXpedition 1985–1987. [*RA9LA, Sergej Levchenko, Heyss Island, 81° N, 59° E, for which the QSL Manager used to be UA9LBR—Ed.*]

AND YOU THOUGHT *YOUR* NATION HAS PROBLEMS . . .

Russia (the Russian Soviet Federated Socialist Republic) contains a bit over half the population of the USSR and three-quarters of the territory. It has some 700 years of history behind it; the USSR (Russia and 14 Soviet Socialist Republics—SSRs) has only 70 years of history, and for many reasons faces constant challenges to its national identity.

There are, for example, more than a dozen religions, including Islam—which also is a way of life and a tradition. This is particularly strong in the south (SSRs 3, 4, 6, 8, 10, and 13 on the map). Since this is the area of greatest growth, Moslems may outnumber all the rest of the population in the USSR by mid-twenty-first century.

And obviously, in a nation which covers one-sixth of the surface of the Earth, weather, terrain, urbanization, industrial development, and agricultural pursuits are extremely varied.

The Russian language is considered to be the strongest uniting bond, yet in the Asian SSRs only about a third of the people have ever spoken Russian. However, the USSR's two main TV channels broadcast in Russian, the majority of the magazines are in Russian, the two official USSR newspapers (*Pravda, Izvestia*) are in Russian as is by far the greatest proportion of the circulation of the other USSR newspapers.

Because of these and other social and cultural differences, it is not surprising that *glasnost* (openness) and *perestroika* (restructuring) in the USSR are accompanied by considerable *smyateniye* (turmoil).

In the amateur radio field as in all facets of Soviet development, it remains to be seen how successful real and permanent changes turn out to be. However, hams, probably better than anyone else, are able to talk across national boundaries with a minimum of attention paid to all the QRMs of inter-nation communications, and can help the hams in the USSR as they work *po-novomu* (in the new way).

EXCERPTS FROM THE *SOVETSKIY PATRIOT*, 4/17/88

"Notes on the All-Union Amateur Radio Conference"

"Now in the world, according to facts from the International Radio Union, there are more than 1,600,000 Amateur radio stations. Of this, 40% are in Japan, 25% in the US, but, for our part, hardly better than three percent. One of the reasons for this is an acute shortage of communications equipment. It's difficult to obtain *many* radio components and other materials."

"[Now] there are changes to the system of forwarding 'cards of receipt.' [*QSL cards*] Now Amateurs may receive them from foreign correspondents not only through the Central Radio Committee, but also at their home address or a box number. Also, the right of transferring amateur radio stations to the first category is given now to the oblast and territorial DOSAAF Committees." [*All-Union Voluntary Society for Assistance to the Army, Air Force, and Navy of the USSR; the oblast committees are local groups for their respective geographical units (oblasts).*]

All countries waited with sharp impatience for the present amateur radio conference. Concerning the technical and amateur radio end of things, so many years of indecision went by that these areas stagnated. That's why the 360 delegates and organizers were agitated, sometimes even excessively.

The representative of the Federation of USSR Radiosport Yu. Zubarev began his speech with problems of the technical aspects of amateur radio—an area today neglected in the organizational plan of the field of the promotion of radioelectronics. The primary reason for that, he noted, is the absence of a branched net of radioclubs with laboratories, masters, and consultative offices, which successfully worked up to the beginning of the 70s. (When reorganization put them under a different administration). . . .

How to rectify the situation? Clearly, what's needed is not only a shoring up of the net of radio clubs, but also to make them broader than before . . . not only radio amateurs and builders, but lovers of radio communications suffered from the reorganization of the radio clubs. Many schools didn't even have a QSL bureau. The quality of of individual and collective radio stations in several oblasts went down. Things were even very unwell with amateur radio communications in the countryside . . . .

The issue, however, was not just an inadequate material base. The development of amateur radio communications couldn't withstand the blow to morale from the raft of many regulating documents. These documents contained more prohibitive than permittive and recommendative points. Therefore, naturally, many paragraphs of these instructions induce just discontent from radio amateurs.

Radio amateurs voiced more than a few reproaches to the Federation of Radiosport, to the local chapters, and to the All-Union Federation. Their actions were met with more than a little formalism, bureaucratism, and high-handed action. There isn't enough "glasnost" in the Radiosport Federation of the USSR. Many questions are decided in the narrow circle, without widespread explanation and the taking of account of amateurs' opinions . . . .

Now, with impatience, the participants of the conference waited for the appearance of V. Bondarenko, the head of the E. T. Krenkel' Central Radioclub of the USSR. This comes as no surprise, as the Central Committee is the headquarters of the development of amateur radio in the country.

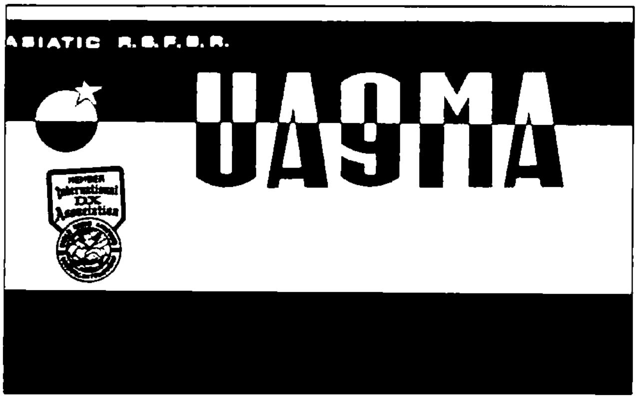
The participants of the conference were not deceived in their waiting. Bondarenko spoke about significant work that went on between the Central Committee together with the department of the Radiosport DOSAAF USSR and the All-union federation before the opening of the conference . . . .

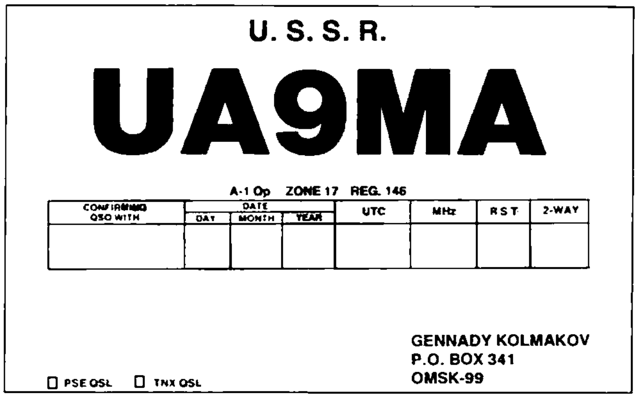
(Hams) have sent letters to the ministries regarding the possibility of the sale of "non-liquids" to radio amateurs. We have already a letter from the ministry of industrial means that reports the organization of trade to radiodealings was taking shape in the "firm" [i.e. company . . . Ed] stores in Moscow, Krasnoyarsk, Volgograd, Nal'chika, Groznyi, Yerevan, Tbilisi, Arkhangelsk, Voronezh, Kiev, Dnepropaviovsk, Simferopel', Sverdlovsk, Irkutsk, Kirovograd, P'skov, and L'vov. ["Non-liquids" are likely surplus ham rigs . . . Ed.]

It must be acknowledged that the discussion sometimes became unruly. Clearly, a widening of democracy by itself still doesn't automatically endow us with the skill to carry a discussion. And a few delgates obviously didn't have the cultivation to respect other peoples' opinions.

[*Look for an explanation of the various committees and how they work together to administer amateur radio in the Soviet Union in 73 in the near future . . . KA1HY*]

(Translation by KA1HY)





Israel Gets the News

"The Iron Curtain has lifted!" says Ron Gang 4X1MK. When regulations for the April 9th. 40th Anniversary Contest were mailed out a set was sent to Box 88 in Moscow, "just in case."

"Imagine the happy surprise when [during the contest, stations] were called by and given contacts by Soviet hams! Probably a mistake on the part of the Russians, it was thought, and some didn't even bother to write in the logs. But a few USSR stations even said to QSL for sure via the bureau, and that was interesting!

"A day later the news was out on the local grapevine. A well-known ham [who had lived in the USSR] had been in touch with his buddies back in the USSR. They reported to him that on the very same weekend we were having our contest, the first-ever convention of radio amateurs in the Soviet Union was being held in Moscow."

The news was passed along: There are no more banned countries—amateurs in the Soviet Union may contact any country, including Israel.

Ron writes: "Are we indeed witnessing the dawning of a new age? Maybe! I heard UP1BYC calling CQ with an overpowering signal, gave him a short call, and Andy and I were immediately engaged in a pleasant OSO, with QSLs promised via the bureau.

"The band being very busy, I slipped up to 15 meters, and heard a Russian station CQing. My first call was ignored, and my second responded to with a request that I OSY. I implored him to respond, saying he could legally contact me now, but I suppose he thought I was trying to lead him on, and he resumed calling CQ. But on the same frequency another Russian called me whom I promptly answered, and in no time I had a small pileup of Russian stations calling me.

"Ten minutes later, the first station was now calling me, apparently now convinced that *glasnost* had taken effect on the ham bands.

"You can no doubt imagine my delight and happiness after all these years finally being able to contact stations which for me and my fellow-country hams had been out of bounds.

"After nearly 21 years we have a lot to catch up on, and I'm now enjoying contending with all the calls from the USSR when I get on HF. Poor 4X1FU, the manager of the Israel QSL bureau! He's going to be snowed under with QSLs, and I suppose it will be kind of hectic until all the Soviet hams have Israel confirmed."

[*4X1MK's regular Israel column is below.—Ed.*]

Notes from FN42

August is an even better month for celebrations of Independence Day than last month: 3—Niger, 6—Bolivia, 10—Ecuador, 11—Chad, 14—Pakistan, 15—India, 17—Indonesia, 19—Afghanistan, and 25—Uruguay. There are National Holidays for Switzerland on the 1st, El Salvador on the 2nd, and Singapore on the 9th. Five National Days: 4—Jamaica, 15—both Congo and Korea, 20—Morocco, and 31—Malaysia.

Other celebrations for you to mention during OSOs: 1—Army Day, China; 3—Memorial Day, Cyprus; 4—Freedom Day, Guyana; 7—Battle of Boyara, Colombia; 8—Bank Holiday in Ireland (on the 22nd for Great Britain); 12—Queen's Birthday, Thailand; 13—Womans Day, Tunisia; 16—Restoration Day, Dominican Republic; 20—Constitution Day, Hungary; 23—Liberation Day, Romania (on the 27th for Hong Kong); 24—National Flag Day, Liberia; 29—Heroes Day, Philippines; and 30—Victory Day, Turkey.

Roundup

Would you like to see *your* name here? It's easy. Just write us something as pleasant for us to read as these words from Comandante Hilton Uohôa of VARIG (Brazilian Airlines): "Yours is by far the best ham magazine. Keep it good. I'm sending for a subscription. Maybe I'll contribute with an article . . ."

China. The first Chinese polar-orbit weather satellite should bo up by now if it is on schedule; an improved satellite for geosynchronous orbit is due in a year or two, making it the fourth in China's development of telecommunications. With a network of ground stations, TV broadcasts from Beijing will reach remote areas such as Tibet.

Code practice at the Holon Bat-Yam club (4Z4YH) that put 4X0R on the air at Masada in April. IARC past-president Ahron 4X1AT (ex-4X4AT), at left, instructs.

New Zealand. A 60th Anniversary is being celebrated in 1988. *Break-In*, the official monthy journal of the New Zealand Association of Radio Transmitters, Inc., turned sixty. Its first issue in 1928 was a four-page newsletter hand-set with metal type; today it is a 40-page journal set on computerized typesetting machines. One thing is unchanged: editorial work is still done by volunteers, with today's team being four ZL3 hams assisted by their families.

The journal survived, with continuous publication, through the cessation of amateur radio during WWII and various other trials and tribulations. With over 700 issues printed and around 250,000 pages of material written by NZART members, it is believed to be the longest surviving amateur radio magazine in the Southern Hemisphere.

The first of 34 editors/co-editors was B. Arthur Hilton ZL1AN; the current editor is Craig Campbell ZL3TLB. Current assistant editors are Ian McPherson ZL3TAO and Brent Collins ZL3TAC; XYL Denise Crawford and John Henden ZL3AFV are ad/graphics editors. (The "T" calls are ZL no-code licenses. "Where would the journal be if ZL didn't have no-code licenses?!" asks ZL2VR.

In its Jubilee issue, Editor Craig wrote, "For the record, *Break-In* is produced in the spare bedroom of my home, by the Editorial team working nights, after slaving all day for our (other) employers (sound effects here should be violins playing). Only the typesetting and printing are contracted out...volunteer enthusiasts have been involved for over 60 years in similar arrangements and in probably even more trying circumstances."

The present circulation of the journal is 3,800, and the completed magazines are hand-wrapped at the printers by a team of high school boys who also sort them by postal area codes for discount postage. The whole process takes them about six hours!

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanegev 85530
Israel

The Phantom Is Unmasked. After four years the longest on-going occurrence of deliberate interference in the history of Israeli amateur radio has been resolved.

When it began, a distorted, metallic-sounding voice (thought to be electronically altered to prevent identification) made itself heard on the Tel-Aviv repeater, taunting the amateurs with various insults, often obscene. Efforts to track down the intruder bore no fruit as he made his transmissions while moving.

This "personality" soon was called "Doctor Bereleh," after the worm in a childrens' book who doesn't come out of his hole. When he was referred to as such during a QSO, the metallic voice suddenly broke in and announced that his name was Doctor Bereleh.

He had no set pattern of operating, and this "fly in the ointment" probably would have been endured, grudgingly, had he not decided to go on to bigger and better things.

In his second year, Bereleh's distorted voice made a megalomaniac announcement: The Tel-Aviv repeater belonged to him, and he had decided to close it down. And indeed, shortly thereafter the repeater couldn't be brought up. The IARC's Repeater Committee technical crew found the cause at the site. A weak pulse signal on the input frequency was keeping it timed out. Only after some serious DFing was a small transmitter found concealed in a tree.

For some time after this, Bereleh was not heard, but about six months later he began making sporadic appearances, generally with a weak signal, taunting his listeners. Once he asked one ham why he wasn't dead yet; he told another he had an ugly wife; and once he turned up on a trucking firm's frequency and had the dispatcher telephone a ham to tell him "Doctor Bereleh would be half an hour late." Annoying but apparently harmless, until . . .

Bereleh started up again with megalomaniac pronouncements. He wanted all the radios back, and had decided to take over the repeater. In late January a noisy pulse-type signal would appear on the repeater at times and obliterate the weaker signals.

Quietly, a hardy band of four hams went to the repeater site (located in a tall building in a Tel-Aviv borough) and waited for the signal to appear. Persisting in painstaking DFing work, they found the source of the interference: a small transmitter concealed in the telephone of a stationery store in the same building. The little rig could be turned on and off by phoning the number of the store and playing specific tones.

The couple who owned and ran the store explained that a telephone company repairman had appeared and taken the phone away for a "repair" he deemed necessary, returning it the next day. They had observed that he then came every morning, bought a newspaper, observed the telephone and connection box surreptitiously, thinking that by wearing sunglasses and a hat he wouldn't be recognized.

A whole detective story followed (too long to tell) to trap the imposter into coming to the store to repair the telephone. At the end, the police didn't arrive exactly on time when Bereleh did come to the store, but the storekeeper got her gumption up and locked the shop door with her husband (a judo expert) and Doctor Bereleh inside; he was held until the police arrived.

The suspect turned out to be a young man, not yet 24, Reuven Kushamaro 4X6KK, unknown to the Israel ham community. He had a business, Rubin Electronics, producing car radio detectors, and a forged army officers ID was found on him. There is a suspicion that he obtained his ham license fraudulently and that he had interfered with the police radio network also. The local popular newspaper, *Yedioth Ahronot* printed a color photo of a skeleton mask and a pistol on the front seat of his car.

Doctor Bereleh was jailed for six days by court order before being bailed out, and his trial is pending at this time. It appears that there may be enough reason to throw the whole book at him, and his repeater interference was one of the minor offenses. It is not clear why he made the repeater one of his major targets; perhaps the sense of it will never be known.

And so ends what has become part of the folklore of ham radio in this country. Doctor Bereleh's distorted metallic voice is heard no more—the phantom of the repeater has been unmasked. And it seems that the episode has had a deterrent value. The other few sporadic nut cases and jammers have disappeared. It is hoped that the polite atmosphere on this busiest of Israeli repeaters will endure.

[***Postscript.*** *Doctor Bereleh's transmitter was auctioned off at the annual Israel Amateur Radio Club social evening. . . to raise money for the IARC headquarters building fund. Talk about making the best of it. . . !—Ed.*]

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

Bunch of News

The special call SP8TPAX has been named to commemorate the first Polish amateur's radio communication, by Tadeusz Hoeftman TPAX, on December 6, 1925. Special QSL cards will be made.

The Piast Club of Radio Amateurs, SP5PAZ, of the Przyszłość Housing Cooperative in Opole celebrated its 10th year. It has achieved 170,000 contacts with 250 countries on SW and 12,000 with 19 countries (167 squares) on USW. It has 130 certificates. It has worked under such calls as 3Z6PAZ, SQ6PAZ, SR6PAZ, and SPØ-FPP, PAZ, and ITU.

Niech zyje Polska! and **Brawo Polak!** (Long Live Poland! and Bravo Pole!) were rewards for Zbigniew Murdzia SP5EKY upon his return from a DXpedition in the spring of 1987. With the call ZK2EKY he arranged a trip to Niue Island in the South Pacific, by special charter plane from New Zealand. Young native boys helped him hang antennas on palm trees. With his FT200 and 300W amplifier, ZK2EKY made 9000 QSOs with 200 countries, 39 WAZ zones (except 34th) and got the WAC certificate on all SW bands except 3.5 (failing to reach Africa).

Ten thousand boy and girl scouts gathered for three days, a year ago, for a meeting devoted to environmental protection. Hams among them made 1037 QSOs with 67 countries and, with a 144-MHz USW station, many SP and SM contacts.

A four-day meeting near Bydgoszcz was organized by the Polish Scouts Association of that town, the Amateur Sports Radiolocation of Poland (ASR), and the District Board of PRAA. Representatives of the Radio Amateur's Association of Yugoslavia and Hans Jurgen Hahn Y23NE were among the competitors. From JO83XH 700 SW QSOs (FT101ZD, 300W amplifier, inverted V and GP antennas) were made, and 150 USW QSOs (FM3031 and FM315, 6-el yagi). At the close of the meet Krzysztof Slomczyński SP5HS was elected ASR president.

The Warsaw District of PRAA held a congress last November of 28 PRAA clubs, 21 clubs of the National Defense League, six of PSA, (1242 associate members), 902 OTs and 340 SWLs. The numbers of senders had increased by 108 and by 55 for SWLs, over the year. Those exceeding 300 contacts on the SPDXC list were recognized.

SPDX 1987 Contest winners were announced. Those placing first in each category (except individual stations) and District ratings are listed in the box. The best five individual stations and their Districts were SP3GEM, KL (306,774 points) and SP5CTY, WA; PS3HLM, GO; SP9DWT, KR; and SP3PL, PO (137,565 points). 73

1987 SPDX WINNERS

District ratings:
Włocławek (WL)
first with 71,831; then, in order,
Elblag (EL),
Katowice (KA),
Poznán (PO),
Zielona Gora (ZG),
Tarnów (TA),
Lublin (LU),
Bydgoszcz (BY),
Gorzdw (GO),
and Kalisz (KL), with
33,889 points.

MHz	Winner	District
1.8	SP9DH	KR
3.5	SP2GVN	BY
7	SP8UFO	LU
14	SP3RBR	ZG
21	SP6CIK	OP
28	SP8EMO	LU

SWL winner: SP9-69006 (KR), and **Club station winner:** SP6PST (OP).

Number 33 on your Feedback card

QTH-DX

QTH is Aruba

Leon Fletcher N6HYK
274 Webster Drive
Ben Lomond, CA 95005

One Of The New Ones

On the tiny island of Aruba (P4), "gold" has been discovered a few times, the most recent "ham-gold." Hamming became effective on January 1, 1986. Aruba now counts as a new country on the DXCC list.

Aruba's first discovery of gold, real gold, was in the early 1800's. Some three million pounds of the precious metal was dug out, but in 1913 the mining became unprofitable.

The second gold rush was for black gold. An oil refinery was opened in 1924. Producing 6.5 million barrels of crude, it was the largest oil refinery in the world for many years. One out of every 16 barrels of fuel used by United States aircraft in World War II came from Aruba. In 1985 the oil ran out, and the refinery closed.

A New Age

By then Aruba's third gold rush was booming, tourism. Travelers discovered the beauties of the island. Cruise ships poured in, bringing thousands of tourists for a few hours of sight-seeing, shopping, swimming, and other leisure activities.

But just a few hours of the island was not enough time for many vistors. So Aruba opened it's first luxury hotel in 1959. At last count there were 14 major hotels, including one giant with 490 rooms, and more being built. Many of the 10 newer developments are full resorts featuring a variety of combinations including swimming pools, tennis courts, shopping arcades, restaurants, bars, banquet halls, convention facilities, casinos, night clubs, discos, and even some elaborate Vegas-type shows.

Great for Hams

"Many of those hotels are very understanding and cooperate with hams. Many will let you put up antennas on the roof," says John Crovelli W2GD, who made four DX trips to Aruba. "The island's ham radio club has about 30 members, but few are active. They meet regularly at their house, on the south shore," John says. "They are a very laid-back people and really friendly."

The current *Radio Amateur Callbook* lists 59 ham stations in Aruba. None are named as holding the highest license classification—Class A. Class A requires CW at 13 wpm with three years hamming experience and allows one kilowatt operation. Getting a ham license to operate in Aruba takes about two months and costs $15, plus $10 more if the operator wants a special P40 call.

To get DXCC credit for working Aruba, a distinctive rule has to be observed. If the operator already has DXCC credit for Netherlands Antilles, he has to resubmit his QSL card from there, together with a separate Aruba card. The Netherlands Antilles card should document that the operator has worked Bonaire or Curacao, not Aruba. The purpose is, of course, to prevent using a Netherlands Antilles card from Aruba to use as credit for both Netherlands Antilles and Aruba.

Aruba became "a separate entity within the Kingdom of the Netherlands," as the arrangement is worded in government publications, on January 1, 1986. Aruba's status is now the same as the Netherland Antilles.

Previously, Aruba was a part of the Netherlands Antilles, six islands in two groups in the Caribbean. One group southeast of Puerto Rico consists of Saba, St. Eustatius, and the southern part of St. Maarten. The other group, near the coast of South America, had consisted of Curacao, Bonaire, and Aruba.

Mixed Lot

Aruba's government seems complex, at least to many outsiders. The governor is appointed by the Queen of the Kingdom of the Netherlands. The 21 member legislature is elected by Arubans. Executive power is held by the Council of Ministers, led by a Prime Minister. Legal decisions go to Aruba's Common Court of Justice, then to the courts of the Netherlands Antilles, and finally to the Supreme Court of Justice in the Netherlands.

Island leaders seem committed, understandably, to minimizing Aruba's longtime identification as a kind of Dutch outpost. In both the major city, Oranjestad, and in the countryside, there are a great many stores, homes, and other structures that have the distinctive design and brilliant painting of typical Dutch architecture. There's even a giant windmill, brought in pieces from the Netherlands years ago, now housing a popular restaurant. But the major tourist publication distributed by the new Aruba Tourism Authority describes such attractive buildings merely as "old architecture and colorful houses."

Language, too, is involved. Most Arubans speak four languages: Dutch, the official language, English, Spanish, and the local tongue, Papiamento. The latter is a mix of Dutch, Spanish, Portuguese, plus some words from English, French, and a variety of African languages. The country's national anthem is sung in Papiamento, and that language is used increasingly in the island's schools.

Aruba has a population of around 65,000, about the same as Greenwich, Connecticut, or Charleston, West Virginia.

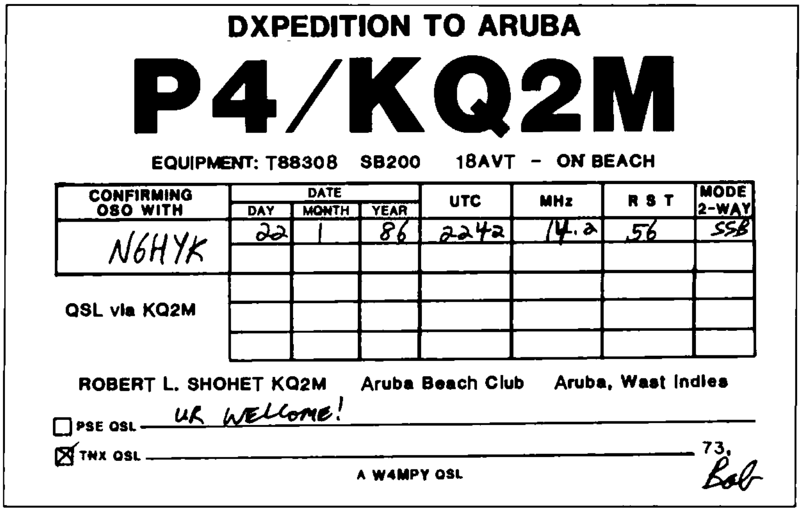
The island is about 20 miles long, six miles across at its widest point, and covers 70 square miles, roughly the same size as Cincinnati, OH, or Spokane, WA.

Lots to Do

For such a small land, there is a surprising variety of attractions, including snorkeling and scuba diving in waters with visibility to 100 feet deep, to tour coral formations, sea life and sunken wrecks. Tourists can hike or drive up the island's highest peak—Yamanota, 617 feet—or hike up the second-highest hill, Hooiberg (Haystack), 541 feet. Hooiberg looks like a giant anthill and is a volcanic formation that's found only here and in Iceland. Many visitors go to Ayo and Casibari to see the unusual rock formations—piles of giant boulders that seem unrelated to the rest of the island. Collectors should not miss the impressive exhibition of coins from more than 400 countries, including ancient Rome, Syria, and Greece, or one of the world's most complete private collections of shells. Of course, shopping opportunities abound with local artwork—paintings, woodcraft, pottery, leather goods, and such—on display everywhere. The Bonbini ("welcome") Festival held on the patio of Fort Zoutman every Tuesday, 6:30–8:30 PM—local foods and drinks, arts and crafts, and shows of music and dance.

Aruba is indeed a unique tropical paradise. Its seven miles of palm-fringed beaches on the southwest coast are among the most beautiful in the world. The rugged cliff-lined shore of the northeast coast, pounded by thundering waves, is spectacular.

But those features help make Aruba a difficult place to DX from—a visiting ham is constantly facing competition between the lure of the island and the thrill of being the focus of a pile-up.


DXPEDITION TO ARUBA

P4/KQ2M

EQUIPMENT: T88308 SB200 18AVT - ON BEACH

CONFIRMING QSO WITH	DATE DAY	MONTH	YEAR	UTC	MHz	R S T	MODE 2-WAY
N6HYK	22	1	86	2242	14.2	56	SSB

QSL via KQ2M

ROBERT L. SHOHET KQ2M Aruba Beach Club Aruba, West Indies

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MARCO: Medical Amateur Radio Council operates daily and Sunday nets. Medically oriented amateurs (physicians, dentists, veterinarians, nurses, therapists, etc.) invited to join. For information, write MARCO, Box 73's, Acme, PA I5610. BNB612

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SOLDERING STATION and TOOLS European and American. Free catalog. Robert W. Mink Import-Export, Box 6437S, Fair Haven NJ 07704. 201-758-8388. BNB682

CHASSIS AND CABINET KITS SASE; K3IWK, 5120 Harmony Grove Road, Dover PA 17315. BNB698

CALL SIGN BADGES: Custom license plate holders. Personal, distinctive. Club discounts. SASE. WB3GND, Box 750, Clinton MD 20735. 301-248-7302. BNB699

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WANTED: Ham Equipment and other property. The radio club of Junior High School 22 NYC, Inc. is a nonprofit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of ham radio to further and enhance the education of young people. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. We sponsor the classroom net on 7.238 at 1100 UTC daily and operate on 21.395 after the Net. Please contact WB2JKJ using the callbook or telephone 516-674-4072, 24 hours seven days a week. Thank you! BNB762

R-390A Receiver Parts: info SASE. CPRC-26 military Manpack Radio, 6 meter FM, with antenna, crystal, handset: $22.50, $42.50/pair. Military-spec TS-352 Voltohm/Multimeter, leads, manual: $12.50. $4.50/piece shipping, $9 maximum. Baytronics, PO Box 591, Sandusky, OH 44870. BNB763

1988 "**Blossomland Blast**" Sunday, October 2, 1988. Write "Blast," P.O. Box 175, St.Joseph, MI 49085. BNB764

WANTED: Hallicrafter SX-117 Receiver in good, bad or partially complete condition, write Joe Karr N9FAU, 3800 Cheyenne Ct., Racine, WI 53404. BNB765

INDIVIDUAL PHOTOFACT FOLDERS. #1 to #1400, $4.00. #1401 up, $6.00. Sams books, $7.00. Postpaid. Allen Loeb, 414 Chestnut Lane, East Meadow, NY 11554. BNB766

TS930S/AT, SO-1TCXO, filters, SM-220/BS8, manuals, documentation, all International Radio mods. AT modified for continuous coverage. $1500. Billy G. Echols WA2NYR/4, 912-462-6940 POB 392, Waynesville, GA 31566. BNB767

WANTED: Schematics & parts list for RF Amplifiers for 36-52 MHz. HG Bachmann WB0SUW, Webster, SD 57274. BNB768

TAP NEWSLETTER Entire 300 page back issue set of phreaking, hardcore hacking and other electronic homebrewing. $30 M.O. Pete Haas, P.O. Box 702, Kent, OH 44240. BNB769

AN/PRC-64 military radio wanted. Will pay top dollar for a unit in very good condition. KC1EZ, Tim McInerney, 316 West 75th Street, New york, NY 10023; 212-874-3333. BNB770

VHF TO MICROWAVE PARTS: GaAsFETS, MMICs, transistors etc. SASE: WA3IAC, 7148 Montague St., Philadelphia, PA 19135. BNB771

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SPECIAL EVENTS

Ham Doings Across the Country

NEW ZEALAND
AUGUST 1 - 6

The Reefton Electrical Centenary ZL6REC, will be operating on 80m or 40m during the day, 20m near 14.250, phone and possibly some CW. The VHF Group hopes to do a static display and communications via satellite. Special QSL to all contacts logged. Please do not send QSL in reply. Contact *Dave Oates ZL3MF, PO Box 20, Westport, New Zealand.*

AUSTIN TX
AUGUST 5-7

The Austin SummerFest will be held at the Austin Marriott Hotel on behalf of the Texas VHF-FM Society. This year's event is also the ARRL Texas State Convention. Flea market, dealer and manufacturer exhibits, ARRL Forum, technical program, transmitter hunt, and VEC. $5 pre-registration, $7 at door. *Austin SummerFest, PO Box 13473, Austin TX 78711. Or call Joe Makeever, 512-345-0800.*

JACKSONVILLE FL
AUGUST 6-7

The 15th annual Jacksonville Hamfest features FCC exams, free Novice exams, prizes, forums, huge indoor swap area, and major exhibitors. For hamfest information, contact *Greater Jacksonville Hamfest Association, PO Box 10623, Jacksonville FL 32207; 904-350-9193.*

TWINSBURG OH
AUGUST 6-7

The Cuyahoga ARS will operate stations K8ZFR, N8HHG, and WB8N from the Twin Days Festival. Frequencies: phone 7.230, 14.245, 28.450, and 146.22/.82 repeater, CW on the lower general portion of the 20, 40, and 80m bands. Special photo QSLs for each station worked, send completed QSL for each station and SASE to *Paul Buescher, 1752 Stone Creek Lane, Twinsburg OH 44087.*

WARMINSTER PA
AUGUST 6-7

The Warminster ARC will operate station WA3DFU from 1400Z to 2200Z on both days to commemorate the 100th anniversary of Revolving Door Day. Frequencies: 3.885, 7.26, 14.26, 21.335, and 28.335. Local contacts on 146.55 simplex. For certificate, send QSL and SASE to *WARC, 136 DeHaven Ave., Penndel PA 19047.*

BERRYVILLE VA
AUGUST 7

The 38th Annual Winchester Hamfest, sponsored by the Shenandoah Valley ARC, will be at the Clarke County Ruritan Fairgrounds. Admission, $4. VEC exams, commercial exhibits. Talk-in on 146.22/.82 and .52 simplex. Contact *Joanne Blaker WB2CMV at 703-869-4878, or write SVARC, PO Box 139, Winchester VA 22601.*

VALPARAISO IN
AUGUST 7

The Porter County ARC, Inc., presents the Annual Northwest Indiana Hamfest and Computer Fair at the Porter County Fairgrounds and Expo Center. Outside/inside vendors, VEC testing. Admission, $3.50. Talk-in on 146.775/175 or 146.52. Contact *Jamie Veiner NS9A, PO Box 1782, Valparaiso IN 46384.*

WARRINGTON PA
AUGUST 7

The Mid-Atlantic ARC will hold its annual Hamfest at the Bucks County Drive-in. There will be door prizes, ARRL representation, refreshments, and exhibits on packet, AMSAT, and ARES. Talk-in on 147.66/.06 and 146.52. Admission $3. Contact *John Bartolomew at 215-356-7197, or write MARC, 203 Second Ave., Broomall PA 19008.*

WEST MIFFLIN PA
AUGUST 7

The 51st Hamfest of the South Hills Brass Pounders and Modulators ARC of Pittsburgh features outdoor/indoor air conditioned facilities, flea market, new equipment, parts dealers, forums, and prizes. Talk-in on 146.13/.73 MHz and 146.52 simplex. Contact *Doug Wilson WA3ZNP, 185 Orchard Ave., Emsworth PA 15202.*

BRANTFORD ONTARIO
AUGUST 13

The Brantford ARC is holding a flea market at the Woodman Park Community Centre. Admission, $3. Door prizes. Talk-in on 146.520 simplex, 147.150 o/p/VE3TCR, 147.750 i/p, 443.025 o/p, and 448.025 i/p. *Marvin VE3MWF, PO Box 1661, Brantford, Ontario, Canada; 519-442-6298.*

ESSEX JUNCTION VT
AUGUST 13

The Burlington ARC presents its annual Hamfest at the Champlain Valley Fairgrounds. Featured are packet/ARES forums, contests, and a flea market. Talk-in on 146.34/.94 MHz or 146.01/.61 MHz. Admission, $4. *Bob Hall W1DQO, General Greene Rd., Shelburne VT 05482; 802-985-2235.*

RHINELANDER WI
AUGUST 13

The 9th annual Rhinelander Swapfest will be the combined effort of the Rhinelander Repeater Association, the Oneida County ARES, and the Tomahawk Repeater Association. Rhinelander Repeater 146.34/146.94, Tomahawk Repeater 144.83/145.43. VEC testing. Contact *Leonard Bauman K9RMN, 1312 Dorothy Street, Rhinelander WI 54501; 715-369-3296.*

AMARILLO TX
AUGUST 13-14

The Panhandle ARC is sponsoring the annual Golden Spread Hamfest at the Camelot Inn. Preregistration is $6 with a deadline of August 11. Tables are $4 each. Discount motel rates are available if the "Golden Spread Hamfest" is mentioned when making reservations at 806-373-3600. Talk-in on 146.94 and 146.67. Write *Golden Spread Hamfest, PO Box 1524, Amarillo TX 79105-1524.*

CEDAR RAPIDS IA
AUGUST 13-14

The Cedar Valley ARC is sponsoring their Summerfest '88 at the Teamsters Hall with computer seminars, FCC exams, a large variety of commercial vendors, and a large flea market. Admission; $3 in advance, $4 at door. Talk-in on 16/76 and 52. Write *Summerfest '88, 2139 Randolph Rd., Marion IA 52302; 319-377-7187/362-3602.*

SOMERSET PA
AUGUST 13-14

The Somerset County ARC will operate NI3D from the top of Mount Davis. Operation will be in the lower 25 kHz of all the general phone bands. For special QSL, send an SASE to *Ernest Gelpi NI3D, RD 2 Box 71, Somerset PA 15501.*

GEORGETOWN KY
AUGUST 14

The Central Kentucky ARRL Hamfest, sponsored by the Bluegrass ARS, will be at Scott County High School. Talk-in on 16/76. Technical forums, license exams, awards, and exhibits in air-conditioned facilities. Tickets $5 in advance, $6 at gate. Free outside flea market space. For more information or tickets, send SASE to *Ed Bono WA4ONE, 2077 Dogwood Drive, Lexington KY 40504; 606-277-3768.*

ST. CLOUD MN
AUGUST 14

The St. Cloud ARC Hamfest will be at the Whitney Senior Center. Ticket donation, $3. Extra ticket, $2. Prizes. Talk-in on 34/94 primary, 615/015 secondary. Contact *SCARC, Box 141, St. Cloud MN 56302.*

TORONTO ONTARIO
AUGUST 17-SEPTEMBER 5

Canada's premier display of amateur radio will be held in conjunction with its largest annual exhibition at the Exhibition Place. Demonstrations for the public on HF operation 10-80m and VHF activity on 2m. Facilities for RTTY and packet. Come along and play. Contact *Thelma Woodhouse VE3CLT; 416-757-5593. For OSL contact VE3CNE, PO Box 307, Station H, Toronto, Ontario Canada M4C 5J2.*

FREDERICTON, N.B. CANADA
AUGUST 19-21

The Fredericton, N.B. ARC is sponsoring Atlantic Hamfest '88 on the University of New Brunswick Campus. The theme is "Approaching the Year 2000." Meetings, seminars, social events, flea market, and commercial displays. Reservations available through *Atlantic Hamfest '88, PO Box 3567, Fredericton, N.B. Canada E3A 5J8.*

ITHACA NY
AUGUST 20

The 7th Annual Finger Lakes Hamfest, sponsored by the Tompkins County ARC, will have a giant flea market, overnight parking/camping. $3 donation, $1 flea market space. Talk-in on 37/97 or 52. Contact *The Kings N2GFW or N2GFX, Box 227, Etna NY 13062; 607-347-4313.*

RENO NV
AUGUST 20

The combined radio clubs of Reno, Nevada, are sponsoring Reno Hamfest '88 from 9 AM to 5 PM in the California Building. Ham swap, prizes, and VEC exams. Talk-in on 146.61 and 147.30. Admission $3. Swap tables, $7 each. For information, registration, exam requirements, send SASE to *Curley Silva K7HRW, 3780 Hummingbird Dr., Reno NV 89506.*

DAYTON OH
AUGUST 20–21

The Dayton Microcomputer Association, Inc., is presenting Computerfest '88 with speakers, seminars, product demonstrations, dealers, and user group information. Admission is $3 per day. For booth and ticket sales, contact *Mark Hanslip, 143 Schloss Lane, Dayton OH 45418; 513-263-FEST.*

HUNTSVILLE AL
AUGUST 20–21

The Huntsville ARC will hold its Annual Huntsville Hamfest at the Von Braun Civic Center. Dealer show, flea market, forums, and walk-in license exams by CAVEC. Free Admission. Indoors, air-conditioned. Talk-in on 146.34/.94 K4BFT. Contact *David L. Reasoner N4KTY, 3103 Holly Hill Rd., Huntsville AL 35802; 205-883-7629 or Don Tunstill WB4HOK, 1215 Dale Dr., Huntsville AL 35801; 205-536-3904.*

INDIANAPOLIS IN
AUGUST 20–21

The Legion of Indianapolis DXers will operate KA9OIH to commemorate the opening of a new addition to the world's largest children's museum. Hours: from 1500 to 2200 UTC on the 20th and from 1700 to 2200 on the 21st. Suggested frequencies: 3.988, 7.288, 14.288, 21.388, and 28.388. For certificate, send QSL and 9 x 12 SASE to *Ham Radio Exhibit, c/o Renee Henry, Indianapolis Children's Museum, PO Box 3000, Indianapolis IN 46206.*

GEORGETOWN DE
AUGUST 21

The Delmarva Hamfest will be at the Delaware Technical Community College from 8 AM to 4 PM. Inside tables are $5, tailgating is $3. Admission $3. Exams. Swimming at beaches. Talk-in on 147.075, 146.52, 224–84. Write *Delmarva Hamfest, Rte. 2, Box 244G, Georgetown DE 19947.*

TOKYO JAPAN
AUGUST 26–28

The Japan Amateur Radio League, Inc., will hold their HAM FAIR '88 at the Tokyo International Trade Center from 10 AM to 6 PM on the above dates. Featured discussions: The Fas- cination of Ionosphere Communication, A Challenge Toward High Technology, and First Encounter with GHz. Commercial exhibits, displays, contests, outdoor flea market, technical forums, homebrew, and ARRL publications. Contact *JARL, PO Box 377, Tokyo Central Post Office 100-91 JAPAN.*

LEBANON TN
AUGUST 28

The Lebanon Hamfest, sponsored by the Short Mountain Repeater Club, will be at the Cedars of Lebanon State Park. Outdoor facilities only, exhibitors bring own tables. Talk-in on 146.31–.91. Contact *Mary Alice Fanning KA4GSB, 4936 Danby Drive, Nashville TN 37211.*

FLORENCE ITALY
NOVEMBER 27

CALL FOR PAPERS. HAMBIT '88, the third international congress of amateur radio and digital techniques, invites papers in Italian or English on telecommunications, CAD, circuit simulation, computers in measurements, digital signal coding, decoding, processing, security applications, computers as aids for the handicapped, and more, no later than August 31. For writing guidelines and requirements, write *HAMBIT '88 Coordinator, Carlo L. Ciapetti I5CLC, Via Trieste 36, 50139 Florence ITALY.*

Index: August 1988 Issue #335

73 AMATEUR RADIO

SEPTEMBER 1988
ISSUE #336
USA $2.95
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International Edition

A WGE Publication

HOT HF ANTENNAS

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09

Welcome, Newcomers!

What is HF?

"So, how far can you talk on that thing—Russia?!"

This is a typical skeptical question non-hams ask as they tour the shack, nodding their head toward the radio equipment. Usually, I sit down, warm up the rig, and within ten minutes prove to them that it is, indeed, possible to speak with Soviets, Japanese, Australians. . .with people in any part ol the world! Often enough, their doubt turns to awe. Direct communication with someone anywhere on Earth is one of amateur radio's classic lures!

Consistent direct worldwide communication occurs only on the amateur radio bands located in the High Frequency (HF) portion of the radio frequency spectrum. Why only there, and not at higher or lower bands?

Look Upward

It helps to first know something about the ionosphere. This is a wide, electrically charged atmospheric layer located 35–200 miles above the Earth's surface. It exists because solar energy from space bombards the upper atmosphere, separating atoms into ions and free electrons. As this energy continues through the atmosphere toward Earth, ionizing as it goes, it grows weaker. Negligible ionization takes place below 35 miles above the Earth.

How does this affect radio waves?—it bends them! As the wave passes from an area of lesser ionization to one of greater ionization, its angle to the division line is less going away from it than what it is going into it. If a wave approaches that division line at a shallow enough angle, the wave departing the division line will travel parallel to that line. If the approach angle is shallower still, the "departure" wave will turn back into the original medium (i.e., the lower atmosphere). You can easily imagine this last scenario for a radio wave from Earth entering the ionosphere, since it's constantly passing into areas of higher ionization.

A wave refracted in the last case travels back to Earth. The Earth reflects it back toward the ionosphere. Waves that travel in this vertical zig-zag pattern between ionosphere and Earth are called sky waves or skip waves. The signals your radio picks up from distant short wave and AM stations at night are carried on sky waves.

Radio waves higher than a certain frequency, however, pierce the atmosphere and continue out into the vast unknown. This happens because they have too much energy and too narrow a wavelength for the ionosphere to contain them. That "certain frequency," called the Maximum Usable Frequency (MUF), varies with how densely ionized the ionosphere is. The more this layer is bombarded with solar energy, the more ionized it becomes, and the higher an MUF it allows. The MUF, however, generally doesn't go above 30 MHz—the top end of the HF subspectrum.

A number of factors determine the minimum frequency for effective skip-wave communications. The two main factors are ionospheric absorption and atmospheric noise. As you go down the spectrum in frequency from the HF subspectrum, the lower layers of the ionosphere increasingly absorb radio waves, and there is a higher level of "natural" noise—random radio waves generated by thunderstorms and other sources of atmospheric static discharge.

Why September?

The fall is the best time for sky wave propagation across the entire HF subspectrum. The upper layers of the ionosphere are still ionized enough to allow high MUFs, which keeps the higher frequency HF bands open. At the same time, however, the lower frequency HF bands are usable because the active weather has subsided, reducing the atmospheric noise level, and the lower ionospheric layers are not so prominent, which leads to less attenuation of these waves. This time of year, it's sometimes even possible to hear DX activity on 160 meters, amateur radio's only Medium Frequency (MF) band. During this time also, you often hear sky-wave activity on the 10-meter band. This is especially significant for newcomers to the hobby: 10 meters is the one HF band on which the Novice—amateur radio's entry-level licensee—has voice privileges! 73

. . .de NS1B

GLOSSARY

Attenuate—Lessen, reduce in power.

Band—A group of frequencies in the radio frequency spectrum. The spectrum contains many subspectra, which in turn contain many bands.

DX—Long Distance. Distances considered DX varies with the band. Distances over 300–400 miles away are considered DX for 160 meters. Worldwide communications on 160 meters is infrequent, but does occur.

Ham—Jargon for amateur radio operator.

High Frequency (HF)—A subspectrum of the radio frequency spectrum ranging from a frequency of 3 Megahertz (3 million cycles/second) to 30 Megahertz (30 million cycles/second).

Ionosphere—A layer in the upper atmosphere, ranging 35–200 miles above the Earth's surface. So called because molecules at that level are ionized (i.e., they lose electrons) by solar rays passing through them.

Medium Frequency (MF)—A subspectrum of the radio frequency spectrum ranging from 300 kilohertz (300,000 cycles/second) to 3 Megahertz (3 million cycles/second). The AM broadcast band is a Medium Frequency band.

Open—Active.

Propagation—The transfer of energy through a medium, such as the atmosphere or space.

Radio Frequency Spectrum—The portion of the electromagnetic wave spectrum that covers waves whose wavelengths range from 30 kilometers to 1 millimeter. The corresponding frequencies are 10,000 cycles/second (10 kHz) to 3000 billion cycles/second (3000 GHz).

Rig—Jargon for a transmit/receive radio, also known as a transceiver.

Shack—Jargon for radio room.

Sky Wave—A radio wave that travels up to, and is then refracted back to Earth by, the ionosphere. A single sky skip wave—one that is refracted just once by the ionosphere—can travel up to several thousand miles. They are mainly responsible for worldwide radio communications.

Voice—This refers to the modulation of the radio wave by signals produced by the human voice. This is normally done by speaking into a microphone. Novice class hams are allowed to operate only CW (Morse code) on the other HF bands.

10-meter band—Amateur radio's highest frequency HF band. It ranges from 28 Megahertz (28 million cycles/second) to 29.7 Megahertz (29.7 million cycles/second).

QRM

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WGE Center
Peterborough NH 03458-1194
phone: 603-525-4201

Advertising Offices
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Contractual Agreement: Under penalty of lost signal strength, you must agree to the following contract. You will no longer neglect Amateur Radio's Prime Directive: to enthusiastically espouse the hobby where no ham has gone before. In other words, get out there and hustle! This is a great hobby, and you owe it to all of hamdom to recruit new licensees from all walks of life. Where do you start? Try your neighbors, unless you've already turned them against you with RFI. How about your local school or church? Put together a packet demo at the computer store. There you go. Now you're cookin'. And above all, let us know how you're doing.

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SEPTEMBER 1988 Issue # 336

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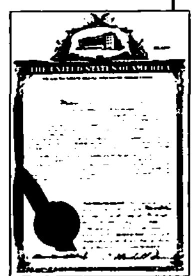

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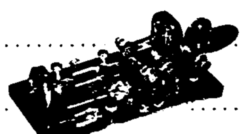

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Cover by Deborah Smith
Photography by Suzanne Torsheya

Number 2 on your Feedback card

NEVER SAY DIE

by Wayne Green

Right As RAIN

A contretemps erupted at Dayton. The Radio Amateur Information Network people were astounded and amazed to find themselves being attacked by the League. I chuckled as I reached for their coats.

For years, the League has broadcast its news bulletins over the Official Broadcast Station (OBS). Despite the FCC regulations prohibiting broadcasting—via W1AW with paid operators—and despite the FCC regulations against paid operators for amateur radio stations, the League is suddenly concerned over the broadcasting by RAIN.

The League sent Mendelsohn, the Hudson Division Director, to do the dirty deed at the RAIN session at Dayton. Steve called the kettle black in front of the crowd, just about destroying the meeting for RAIN.

Hmmm, wondered those not too gifted with acumen, what ARE the FCC rules about broadcasting? Golly, gee, the rules do say that broadcasting is prohibited. The RAIN people went into logic fibrillations while Mendelsohn, displaying his most benevolent sneer, snickered inwardly at how he'd snookered them, wiping the blood from his verbal snee.

Arguing about the FCC rules is as productive as arguing about Bush's platform—with solid answers as elusive. Sure, broadcasting is prohibited. It's illegal. But it also isn't defined. In that respect, the League hasn't been flat out breaking the rules all these years—only in spirit. Not like the paid-operator rule, which the FCC has known about from day one and blind-eyed. Tsk, another scandal. Ho hum.

The RAIN crowd—and it's getting to be a large crowd these days—has broadcast "bulletins" on 3975, 14275 and 28475 at 1300, 1700, 2100, 0000 and 0400Z daily. They encourage their large network of stations to tape these broadcasts and repeat them on other bands, via repeaters and so on.

With relays all over the world—New Zealand, Australia, Japan, South America, Central America, Europe, and the Middle East, there is an understanding of why the League might be beginning to panic. In case your knowledge of ham history is vague, the League has maintained its position as the only representative of amateur radio in America by ruthlessly killing off every upstart. Hey, that's the American way, right? That's the way our corporations do it—the way one of our largest industries, organized crime, does it—the way politicians do it. You can't ask for a more accepted and pragmatic approach to survival.

RAIN has thousands of listeners who tune in to their broadcasts every day. Indeed, I suspect that the only thing preventing the listening audience from becoming two or three times its size is the inability of so many amateurs to translate GMT (Z) into local time . . . so they're never sure exactly when to listen.

I'm exaggerating, right? There goes Wayne again. Well, let me lay it out for you where it hurts—many hams can't tell time. I've DXed from dozens of countries and then come back to stacks of QSL cards. When I try to square the cards with my log sheets I go bananas. An amazing percentage of the DXers—the hams you'd think by now would have some inkling as to what time they've made a contact—even what day—get it wrong. I have to go through my logs, first checking plus or minus ten minutes or so to make up for the old Timex watches being used. Then I have to check plus or minus one to three hours—or translate from Central Daylight Time to GMT—for those who don't know just what the GMT time is. If I still can't find it, I try a day or two either way to make up for their using a calendar from some other year.

Messages of interest to amateurs are permitted to be broadcast by the FCC. It doesn't say

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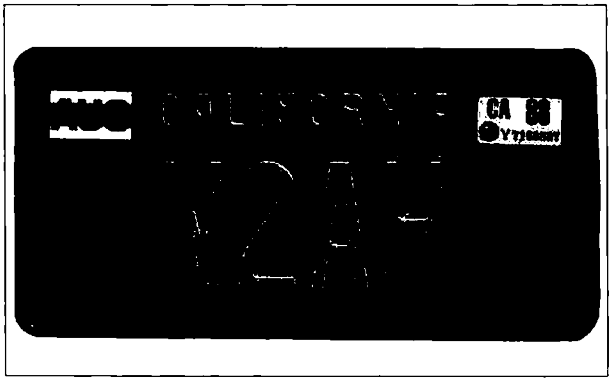

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To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Net-Rom vs Nord Link

The average voice or CW enthusiast may have never heard the names Net-Rom, The Net, or Nord Link, but they mean a lot to packeteers. Now, these names could be the basis of the first big law suit to hit the packet radio community.

Both Net-Rom and The Net are programs designed to work with TNC 2-type packet controllers. They enable the digipeaters to network together for long-distance message routing. Net-Rom, a commercial product from a company called Software 2000, was first on the scene. Recently, from the other side ot the Atlantic came The Net—a free, public domain program from a German packet group called Nord Link.

The German programmers say they designed The Net to be compatible with Net-Rom, with added sophistications. Mike Busch W6IXU and Ron Raikes WA8DED, who wrote Net-Rom, allege, however, that The Net is essentially an unauthorized reproduction of their copyrighted Net-Rom program code. Nord Link maintains they did their own program development, adding that they were disenchanted with having to buy new software every time there was a Net-Rom update. To add insult to injury, Nord Link moved up the release date of its latest source code of The Net by several months—it's now available free of charge.

Whether or not Nord-Link pirated the Net-Rom packet software still has to be determined. Net-Rom is a copyrighted product under United States law, which gives legal avenues to Software 2000.

AO-13 Update

The latest OSCAR is alive and well. Radar-derived Keplerian elements have replaced the estimated ones. The first set obtained by AMSAT-NA and relayed by KA9Q is as follows:

Temporary Catalog Number:	83803
Ref Epoch:	88167.6
Inclin:	10.056
RAAN:	244.932
Eccen:	0.7312844
Arg Per:	178.294
Mean Anomaly:	95.643
Mean Motion:	2.2535717
Decay:	0
Orbit:	0

The beacon frequencies are:

Mode B:	
GB:	145.812 MHz
EB:	145.985 MHz
Mode L:	
GB:	435.651 MHz
EB:	435.677 MHz

AO-13 may be heard on any one of these frequencies. The transponders should be available anytime.

For more information on getting started in satellites and on AMSAT membership, call AMSAT at 301-589-6062 or write: AMSAT PO Box 27, Washington, DC 20044.

No Worries, Mate

Special parking signs giving exclusive parking rights to radio amateurs are appearing throughout Australia. The Local Government Organization of Australia (LGOA), passed this resolution at its annual national conference in Melbourne. The LGOA amply praised the amateur radio in its news release about the resolution:

"The new signs are in recognition of the valuable contribution made by wireless experimenters, and now radio amateurs for just on 100 years . . . without their help, many local municipal plans would be inadequate."

The signs have been available from 1 April 1988 for erection at places visited by radio amateurs, including outside electronics stores and radio clubrooms.

Let's hope the folks "downunda" are setting a trend that will spread this way!

Drop by Dublin

The North Dublin and Fingal Radio Clubs are hosting the first annual EI Hamfest 24–25 September. There will be lectures on all aspects of amateur radio by speakers, including Louis G5RV, the inventer of the famed 160–10 meter wire antenna, and Hugh Turnbull, director of the Atlantic Division of the ARRL. The event will finish off with a large radio and electronic exhibition, earlier known as the "Junk Sale."

The Junk Sale started 10 years ago, when Ireland had little amateur activity (300 licensees and 180 active hams), and quickly grew to be the biggest ham radio related gathering in the country (and in GI-land). There are now 1200 licensed and 800-900 active hams in Ireland, many drawn into the hobby by this event.

INTA

The first six-meter openings, between Great Britain and the United States, occurred in the afternoon and evening of 6 June. G4ASR near Hereford worked fifteen stations in call areas W2, W3, W4, and W8. He also contacted a VE1. The opening lasted from 15:23–17:23 GMT. GJ6OZB says that he worked a total of fifty-eight stations in nine states. Three other stations in the north of England report contacting an FP8!

One negative note—German stations heard on 6 meters are operating illegally. They have neither licenses nor permits for 50 MHz operation, and should not be worked.

DARA Awards

Four young hams are a thousand dollars closer to fulfilling their educational goals thanks to the Dayton Amateur Radio Association. Lynn Bailey KA8PWD, Scott Sterling KA8UGM, Ross Lepiane WG7I, and David Milthaler N8GFX have been named as this year's winners of the annual DARA scholarship awards program. Each student will receive one thousand dollars to use exclusively toward paying their tuition at the college of their choice.

The Dayton Amateur Radio Association's scholarship program is open to any licensed amateur graduating from high school in the year an award is given. For further information about this program write to: The Dayton Amateur Radio Association, Scholarship Awards Program, 317 Ernst Ave., Dayton, OH, 45405.

Up, Up, and Away

The first of a series of Indiana balloon launches was a complete success. The W9PRD/WB8ELK balloon launched at 13:59 UTC on Saturday, 4 June. The flight ascended to at least 115,000 feet where it finally burst at 16:28 UTC. Early reports showed that the 2m beacon was heard as far away as W0RPK's OTH near Des Moines, Iowa, a range of 460 miles. While the 2m beacon was intermittent, it was strong and heard "nearly full quieting" by N8IWJ in Dearborn, Michigan on an HT with a whip antenna. ATV signals were strong within 200 miles of the Greensburg, Indiana launch site.

After bursting, it continued to transmit all the way down, for 5 hours thereafter, until it was located and recovered in the thickest part of the Hoosier National Forest after a very difficult search. Searchers found the remnents hanging 60 feet up in a tree with the electronics package some 20 feet off the ground. If it hadn't still been transmitting, they never would have found it. At recovery, its 13.3 volt lithium batteries were still reading 12.8 volts. WB8ELK indicates that a future launch will carry a television camera on board.

Thanks To . . .

***Westlink Report*, N8ADA, AMSAT News Services, RSGB, and EI2FRC. Send in all news items, photos, and other graphics concerning amateur radio to: *73 Magazine*, 70 Rte. 202N, Peterborough, NH 03458-1194, Attn: QRX**

ANTENNA SYSTEMS

Sometimes "good" is bad and "bad" is good.

John Lawson W3ZC

It is always a good idea to have everything in the antenna system matched. That is, 50Ω transmitter output, 50Ω transmission line, and a 50Ω antenna. This is rarely the case. If these conditions are not met, then it is important to know what gains can be realized for the effort expended. Stated very briefly, once we correctly understand mismatch and reflections in antenna systems we can obtain improvement in operational antenna flexibility.

This may be a bit optimistic because just about every ham has his own feelings and opinions regarding antenna systems, especially his own. Amateurs are results-oriented and what works *works*. Different amateurs have different desires and wants from ham radio. Some may erect an antenna and be satisfied to work Canada, Germany, Great Britain and the like. Therefore, his opinion of his antenna is that it is good (whether it is or not). For other amateurs, these kinds of results are not good enough. For him, the same antenna system is no good. The intent here is to get you, the reader, to understand or re-evaluate some thoughts on antenna systems, particularly when a decision point is reached.

In my 35 years as an amateur, it is my observation that the weakest link in any ham's knowledge of radio is his understanding of antenna systems: when to adjust and when to leave alone, when to discard and when to retain. The word today is that *SWR is King*. Most hams don't understand what SWR is, or know what it means. This is not entirely the fault of the amateur. Articles containing explicitly erroneous information and distorted concepts find their way into print, become gospel, and continue to be propagated. This incorrect information includes such pearls as:

1. Always requiring a perfect match between the feed line and the antenna.
2. Evaluating antenna performance, or radiation efficiency, only on the basis of feed line SWR.
3. Pruning a dipole to exact resonance at the operating single frequency and feeding with an exact multiple of half wavelength coax.
4. Adjusting the height or apex angle of an inverted V to make the resistive component of the antenna impedance equal to the line impedance.
5. Subtracting the reflected power from the forward power to determine the usable transmitter output power. Nomographs have even been published for this determination.

As a result of these misdirected concepts we have been conditioned to avoid any mismatch and reflection like the plague. 'One to one' all the way. These were also the observations of M. Walter Maxwell, W2DU, in his series of excellent articles that appeared in *QST* in the 1970s. After reading Maxwell, McCoy, or the ARRL publications, it is clear that any discussion of antenna systems is not for the faint of heart. It can get pretty deep. Although this article references these writings, it is shorter, more to the practical point, and is less technical.

History

Perhaps some history is in order. I have been around for a while, but I was not part of the pre WWII activity which is where this story begins. Before WWII, there was no coax cable or SWR bridges. Antennas were fed with open wire, which is two wires separated by spacers. This is still, by the way, the lowest loss transmission line available to amateurs today. Fifty ohms was just another resistance value. Open wire transmission line is several hundred ohms in impedance, and is dependent on the spacing and wire size. Pre WWII hams monitored antenna performance by field strength meters, antenna current RF meters, bulbs, sparks, and RST reports. How did they couple power from the transmitter to the antenna *system*? Most transmitter outputs had swinging links, Faraday shields, and large wide-spaced output capacitors.

This section of the transmitter was called the "antenna coupler" which was really a misnomer. It should have been called the "antenna system coupler." It did nothing to match the antenna to the input of the transmission line. It matched the transmitter output to the transmission line antenna combination. After WWII amateur radio entered the era of coaxial cable. Coax was used extensively by the military during the war and became available to hams after the war.

Enter Coaxial Cable

What is coax cable? It is two conductors (cylinders, if you will) concentric with one another separated by a dielectric material. If the cable is made uniformly, its impedance does not change with length. That is, a piece of 50Ω cable, properly terminated, is 50Ω whether you're looking at a 6 foot length or a 100 foot length. The impedance is determined by the conductor sizes, the spacing between the conductors, and the dielectric material. Fifty ohm cable was a practical size of cable to use because its physical properties *made* it practical. Hams readily accepted coax because it was easy to run and connect, and with TVI rearing its head, it was important to have a shielded transmission line.

It had several drawbacks. One was it was more lossy than open wire. Another was it came in such low values of impedance—a far cry from the 600Ω open wire. Thinking had to change. This was the start of the 50Ω system. Antenna designers fell into line, as did transmitter designers with the pi net output circuit. The pi net made it easier to match the transmitter output to the antenna system.

The pi net was more attractive to manufacturers because it eliminated some of the more costly components and was more acceptable to amateurs because of its ease of adjustment. The pi net is really part of the transmitter and can be considered an antenna tuner, or, more precisely, an antenna system tuner.

Antenna Tuner

What does an antenna tuner do? It matches the transmitter output to the antenna system. It does not change the mismatch within the antenna system itself, such as between the transmission line and the antenna. Tuning the antenna system does not have to be part of the transmitter. It can be outboard, like a Transmatch, a "T" match, or an "L" match.

Transmatch

Stated as simply as possible, a Transmatch

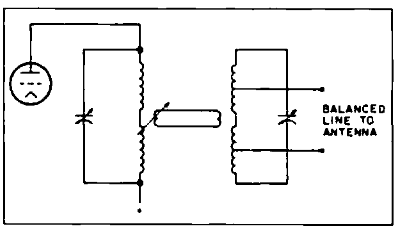


Figure 1. Typical pre-World War II output circuit.

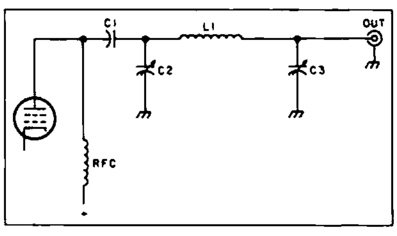


Figure 2. Pi-network transmitter output circuit.

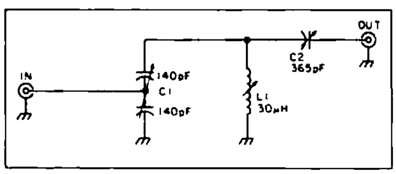


Figure 3. A transmatch used to match non-50Ω antennas to transmitter output circuits.

is a circuit consisting of coils and capacitors that is a "reactance tuner-outer." It is a combination of coils and capacitors that make up an adjustable RF transformer. The function of a good Transmatch is to take an unknown load of an antenna system and convert it to a load that is compatible with the transmitter by inserting a conjugate match into the antenna system.

Conjugate Match

A conjugate match can be explained for amateur radio as follows, without getting too deeply involved in the R ±jX situation.

If your antenna is too long for the frequency of operation, the antenna is inductive. So you must add capacitance to compensate so that the transmitter sees an impedance that it can tune. The cap that you add is the conjugate match. Similarly, if the antenna is too short, the antenna is capacitive. You must add inductance. The inductor that you add is the conjugate match.

A conjugate impedance is really a match of opposite polarity for the mismatch. It is always a "C," (which is −) , or an "L", (which is +), or a combination (such as in a Transmatch). Reactive components such as C's and L's do not consume power. Resistors do. So you don't want to add any R. In real life there is always resistance—the resistance of the wire in the coil, the leakage across a capacitor, the resistance of plugs and receptacles including coax connectors. But the advantages gained by adding the proper L or C far outweigh the disadvantages of inserting a small amount of R.

R ±jX

First, two facts must be stated that should be easy to accept.

1. Power can only be absorbed by a resistive load. A resistive load may consist of a resistor, the resistance of the wire in an inductor or coil, the leakage within a capacitor, or the radiation resistance of an antenna.

2. Power cannot be absorbed by an open circuit, a short circuit, or reactive components such as pure inductances or pure capacitances.

These facts should be easy to accept.

In an amateur radio transmitting setup the following components are usually available.

When everything is matched, maximum power is absorbed by the antenna because the impedance of the antenna at the frequency of resonance, F_r, is R + j0.

What does this mean? Briefly, the convention for expressing a complex impedance, that is, one containing resistance and reactance is in the form R ±jX, where R is resistance and X is reactance. The "j" is equal to the square root of I which is undefined, and, unfortunately, appears quite often in engineering. (The + denotes inductive and the − denotes capacitive.)

Back to the scenario. At resonance the impedance of the antenna is R + j0, which indicates that it is only resistive and the antenna will absorb all of the available power. If you lower the frequency of operation, the antenna is too short (capacitive) so

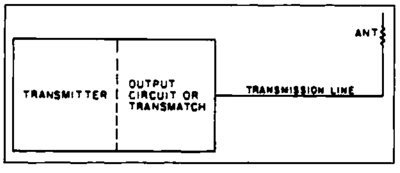


Figure 4. Typical transmitter and transmatch arrangement with antenna system.

the impedance of the antenna is R − jX, where "X" is some value of reactance. If you raise the frequency, the antenna is too long (inductive so the impedance of the antenna is R + jX.

In the case where the antenna is too long, such as when you have a resonant dipole antenna at 3501 kHz and you tune up on 3999, the antenna is inductive.

The assumption is that the transmitter output circuit can be tuned properly, or that a Transmatch is in the transmission line. The power wave going down the antenna sees an impedance of R + jX when it reaches the antenna. Since part of this impedance is reactive, some of the power wave will be reflected and not absorbed by the antenna.

When the reflected wave reaches the input of the transmission line it sees an impedance of 0 jX in the output circuit of the transmitter or in the Transmatch, if one is used. Since the "R" portion of this impedance is zero, no power is absorbed (fact 2 above and the reflected wave is re-reflected towards the input of the transmission line, adding to the power wave from the transmitter.

This is why when you tune your Transmatch you read a higher power before you have the final matched settings. After you have set the power output tuning properly, the re-reflected wave does not travel past the transmitter output circuit or Transmatch, so all you are reading is the matched transmitter output power.

The common belief that high reflected power damages the transmitter output tubes or transistors is hogwash. It just doesn't happen. The reflected power wave never reaches the finals. If no type of matching device (such as a Transmatch) is used, the reflected wave does cause a change in antenna system input impedance, which makes loading difficult. If the transmitter can be loaded properly without a matching device, the output circuit re reflects the reflected wave the same as described above. The finals are safe from the ravages of the reflected wave. If your transmitter cannot load properly, things will heat up, possibly arc over, and cause general grief. The solution is to add a matching device, such as a Transmatch, so proper transmitter loading can be effected.

SWR

And along came the SWR bridge. Here was an easy method of checking something in the antenna system without resorting to RF meters mounted at the antenna feed point and using binoculars to read it; or resorting to RST reports which at best were and are not very reliable. There is one attribute about the ham community that is almost universal. And

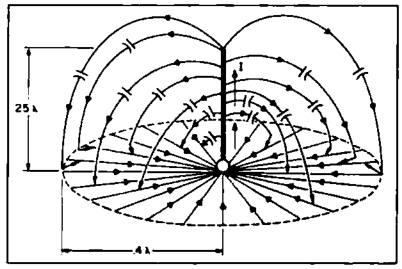


Figure 5. Quarter-wave vertical antenna near-field electrical characteristics.

that is that they don't like to offend other hams. The receiving ham will give the best possible report, often erroneous, because the transmitting ham many times will not take too kindly to a bad report.

So, RSTs are usually out as far as performance is concerned. Oh, one ham in 50 will give you a conscientious report. If you find one, keep this person in mind when you decide to do some antenna work.

What are SWR meters and what do they measure?

SWR meters are used to give direct reading SWR values. You tune up your transmitter and adjust a knob on the SWR meter to obtain a full scale reading with the switch in the 'forward' position. Then, without touching the knob, you switch to the 'reflected' position. The scale is calibrated in SWR and the meter will read directly. Many hams today have reflectometer type power meters that read forward and reflected power. There is no adjustment. You read forward and switch to read reflected. With this type of meter you must calculate the SWR from the equation

$$SWR = (1 + k)/(1 - k)$$

where k is the square root of the ratio of reflected to forward.

This can be cumbersome. Most hams remember a couple of values and extrapolate. That is, a reflection of 10% = an SWR of 2:1. A reflection of 50% = an SWR of 6:1. The only thing that an SWR bridge measures is the degree of mismatch in the antenna system. In itself, it cannot tell you about the efficiency of your system. In itself, it cannot tell you about the performance of you system. What it does tell you is that your transmitter (and by the way, your receiver is looking into a matched or mismatched antenna system.

This does not mean that if you are obtaining a one to one that you have a good system.

Other Considerations

The following discussion is an example of how other factors besides the feed line and antenna enter into the picture in a discussion on a vertical antenna situation. Before we get to discussing a vertical antenna situation, I would like to refer you to the Table 1 that can be used to convert those wretched dB's to something more understandable.

A couple of things should be said about dB's. First, this table relates to power and not to voltage. The voltage dB chart is something different. Second, to use the table you must determine if you're talking gain or loss. Then

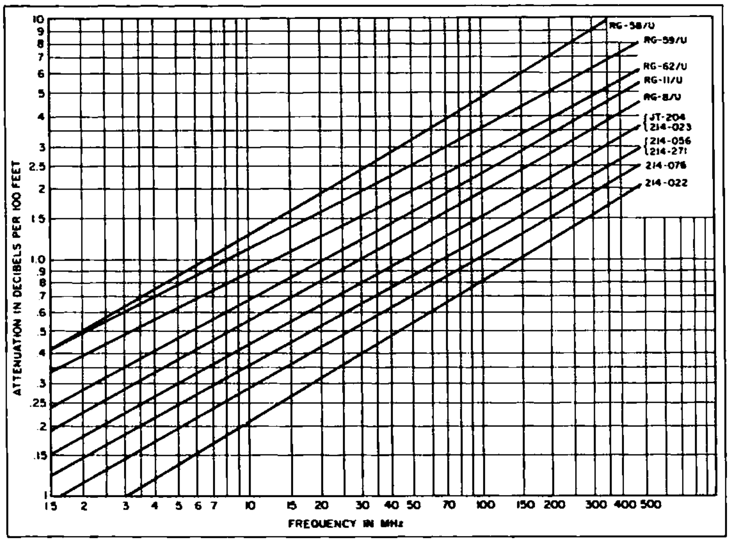


Figure 6. Signal loss through coaxial cable according to frequency and cable type. From ARRL Antenna Book.

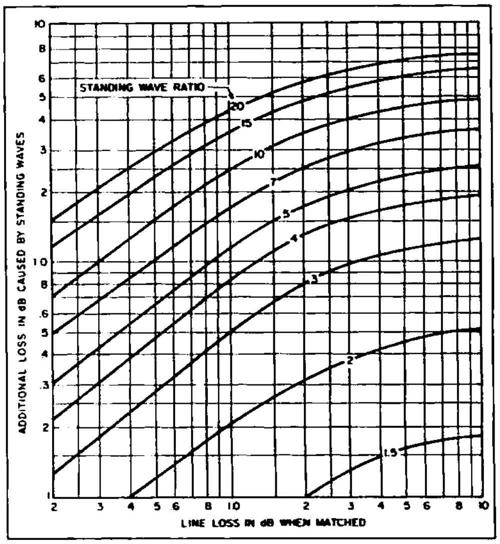


Figure 7. High SWR on a transmission line can cause significant additional signal losses.

you go to the dB figure in question and multiply the input by the number appearing under 'GAIN' or 'LOSS' to get the output. For instance, if you're running 10 watts to an antenna with a 3dB gain, your effective radiated power is 20 watts. Every 3dB your gain doubles or your loss halves. This table will give ratios.

It is well documented that in order for your signal to be heard just perceptively stronger at a distant receiver, the signal must increase by 1dB. Looking at the chart under 1dB, this means that you must effect a 26% increase in radiated power. If your radiating 100 watts and you devise a method to increase your radiated power, unless you increase it to 126 watts, your signal will not be heard any stronger by a distant receiver. So, *you* will have to weigh the benefits gained by making the changes. If you are thinking about changing your RG 8/U coax to hard line at HF, where the RG 8/U loss is 1.0dB max and the hard line loss is around 0.3dB, you've gained 0.7dB. Your signal will be no louder. And you've spent a lot of money.

Vertical Antenna

The moral of this story is that low SWR does not necessarily mean a better antenna.

Joe Ham erects a 40 meter vertical antenna. Joe Ham decides that he is going to try this thing out before he goes to the trouble of installing ground radials. What he does do is to drive an 8 foot copper clad rod into the ground at the base of the vertical. That should satisfy the ground requirements, he thinks. He tunes up and finds that his SWR is one to one. This is great and decides *not* to install ground radials. He doesn't need them. He is one to one. The reports he gets from the fringes are satisfying. Over the back fence he mentions his apparent success to his neighbor, Skippack Fats.

Now Fats knows that ground radials are needed for optimum performance and offers to help him install a set using Fat's wire and an old DeSoto hubcap as a terminating point. Fats knows that from a theoretical standpoint that about 50 radials are needed. But he doesn't have that much wire, so they install 20 radials about 50 feet long and Joe Ham tries it out. He notices that the SWR is now 2:1, and that bothers him because without the radials he was 1:1. Nonetheless, he makes some contacts and finds his reports are better with the radials installed. Joe relates his concern to Skippack Fats and Fats calls in the RF Hill Technical Committee, of which he is a principal.

The question poised to the committee was "Why does a good antenna, as determined by its low SWR, not seem to work as well as an inferior antenna with a higher SWR?"

The committee knows that a vertical over ground exhibits an impedance of 36Ω, but can be as low as 25Ω. How could Joe Ham obtain an SWR of 1:1 in a 50Ω system with no radials?

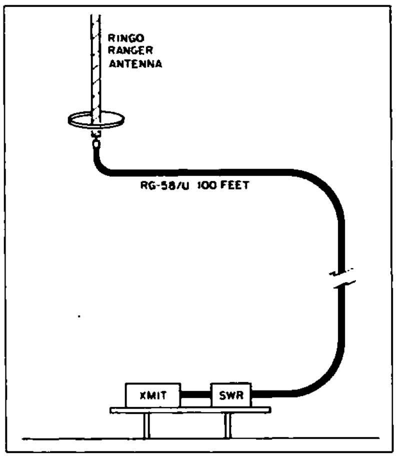


Figure 8. The VHF transmitter and antenna arrangement discussed in the text. SWR read low at the transmitter, while it was very high at the antenna feedpoint.

One of the members was able to borrow some exotic equipment from work, and with it, they determined that there was nothing physically wrong with the antenna itself. In doing so, they noticed that the ground was full of rocks and shale. With another piece of exotic equipment they measured the ground resistance parallel to one of the radials. They measured 25Ω, which is not unusual for that type of ground.

What about the ground rod at the base of the vertical?

An electrician, by trade, is a member of the committee and he knew that the ground rod was good lightning protection, shunting the power of the pre strike field deep into the earth. But for RF? Forget it. The ground currents of RF above 3MHz travel on the top inch or two of the soil and they make a bee line for the RF return at the feed point. The ground rod does nothing for RF.

Now Fats knows that antennas have two fields that are of concern to amateurs—the ***near field*** and the ***far field***. He also knows that the far field does not enter into this situation and that the near field pattern of a vertical is like an umbrella with the tips coming down to a level even with the handle.

RF currents flow within this quasi-hemisphere to form the RF ground return. Actually, the RF currents are capacitively coupled but nonetheless, it is the RF ground return.

The following deduction was made:

25Ω antenna impedance
25Ω ground impedance
50Ω total impedance

This is what the antenna end of the 50Ω transmission line saw. 50Ω line, 50Ω terminating impedance, ergo SWR of 1:1.

When radials were added the ground currents had a clean shot to the ground side of the transmission line, essentially zero ohms. 50Ω line, 25Ω terminating impedance, ergo SWR of 2:1. SWR is figured by the simple ratio of one impedance over the other, the larger one on top.

THE ALUMINUM CLOUD ANTENNA

A top performer for cliff dwellers

by David F. Gauding NFØR

As a confirmed "cliff dweller," I have resorted to some rather desperate measures in attempts to put out a respectable signal. Fortunately, my all-band Aluminum Cloud, using standard design formulas for a center-fed zepp or the G5RV, performs consistently in a condominium attic.

Replacing traditional wire elements with aluminum foil in either 12- or 18-inch widths, produces an antenna with a massive capture area and an apparent improvement in the reception of weak signals. As a bonus, there is a significant increase in capacitance, insuring that the design loads easily use a transmatch with a balanced input.

Construction is somewhat involved, but the completed antenna can be transported and installed without difficulty or damage to the fragile elements. The materials are quite simple and inexpensive: heavy duty aluminum kitchen foil, 3/4-inch masking tape, and braided nylon fishing line, or other small diameter cord that will not stretch under tension. Two alligator clips and 300 or 450 ohm twinlead will handle the feedline requirements.

The foil should be rolled out and measured on a hard surface to insure that both sides are cut to equal length. Using a yardstick as a guide, turn up a 1-inch edge to a 90 degree angle along the full length of each element. After allowing for additional material to reach the antenna support point, lay the nylon line in the angle and fold the foil over so it is flush with the main surface. This "sandwich" is now sealed with masking tape to create a secure joint. Tape is then applied to the remaining borders on one side of each element to prevent tearing the aluminum. Finally, reinforce the foil further by applying strips of tape vertically from top to bottom at 12-inch intervals.

If each element is fabricated separately, the nylon lines should be tied together at this time to ease installation. The completed antenna may be rolled in loose coils approximately 12 inches in diameter, carried into an attic without fear of damage, and then extended in the desired location.

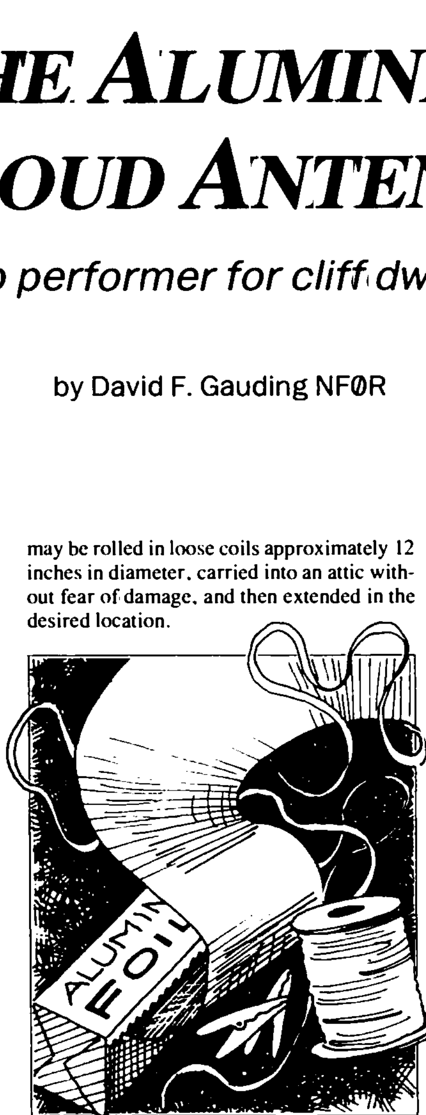


Illustration by Anne Vadeboncoeur

After the supporting line is tightened, the two elements will slide easily for best positioning. A 2-inch separation is adequate. If the antenna is configured as an inverted vee, the elements may overlap after installation. The foil can be folded back to avoid contact, but the preferred alternative is to make allowances while constructing the antenna by trimming the aluminum to the appropriate angle. Since the foil has been reinforced by masking tape, the feedline can be attached at either the top or bottom of the elements with alligator clips.

The attic of my townhouse peaks at 27 feet with the working area for antennas measuring 23 by 26 feet. My original 33 foot antenna is positioned on the diagonal as an inverted vee, and was designed to operate on 10, 15, and 20 meters. I was surprised to discover that it could also be resonated on lower bands, and I attributed this good fortune to the additional capacitance created by the aluminum foil. Performance on 30 and 40 meters was adequate for my purposes, though as expected, bandwidth was significantly reduced.

Later improvements included the addition of clip-on wire extensions to the foil elements. Creative positioning of these wires throughout the attic to avoid using lossy traps or coils, eventually brought the antenna up to the 102 foot length of a G5RV, while the feedline was increased to 33 feet. Most importantly, the aluminum foil continues to be located at the point of highest current, and definitely makes a favorable contribution to the performance of the final version.

The antenna, in various forms, has been used actively for over four years. With a borrowed rig, I confirmed my suspicions that it would also function effectively on 160 meters by toploading, and from the midwest I worked numerous east coast and southern stations in this experiment. With 45 watts output from a Ten Tec Argosy, my DXCC total now stands at 129 with 60 of these countries worked at QRP power levels of less than five watts. Most of this activity has taken place on 15 and 20 meters, though Europe and South America are worked regularly on 40 meters. Stateside operations on 40 and 80 meters are routine, and produced WAS-QRP during the decline of Cycle 21.

So much for the heroics at NFØR! I occasionally entertain thoughts of making all my antenna elements from aluminum foil, but recollections of crawling around the attic on all fours, accompanied by painful bruises on my balding head and tender knees, quickly put them to rest. At those times, I realize that the antenna is superior to simple wire designs, so there is not much point in trying to fix it. Having an exotic DX station answer my CQ on CW, SSB, RTTY, or packet is proof enough. ■

Number 6 on your Feedback card

73 Review by 'Bill Clarke WA4BLC

Butternut Butterfly Antenna

An antenna for small quarters that takes a little more work—but well worth it!

Butternut Electronics, Inc.
405 East Market
Lockhart TX 78644
Price Class: $272.50

Modern urban and suburban settings generally preclude the erection of full-size directional HF antenna systems. This relegates many hams to verticals, wires, dipoles, or compromise beam antennas.

Several months ago I assembled a Butternut Butterfly HF5B antenna and installed it on a fifty-foot push-up mast. It's a compromise antenna designed for limited space installations.

Photo B. The completed Butternut Butterfly on a push-up mast with a TV rotor. Note the extensive tuning devices used. These are what take so long to assemble and tune. It's worth it!

Assembly and Tuning

The antenna kit contains many parts—more than forty—that must be carefully assembled. All fastening hardware is stainless steel and all aluminum parts are properly cut and nicely finished.

The instructions are very clear. The builder must adhere to them exactly. Total assembly time was about six hours—somewhat more than the time it takes to put together a typical three-element tribander.

After completing the assembly, I put the antenna on a push-up tower so I could work on the antenna at rooftop level. This made tuning and adjusting easier. Fine tuning the antenna greatly affects front-to-back ratio and, to a lesser extent, forward gain. I made very small adjustments—just fractions of an inch at a time. Recording the initial test readings of SWR patterns and comparing them with those in the instruction manual was very helpful.

I first adjusted the antenna for 20 meters, and then tor 10 and 15 meters. I spent about an hour making the final adjustments, and then raised the antenna to its operating height of forty feet.

Photo A. The many parts that make up a Butterfly antenna.

Operating the Antenna

I have been using the Butterfly now for six weeks and feel that it was worth all the time spent in construction and adjustment.

I compared it with a three band vertical, multiband dipole, and a three-element tribander. The only pieces of test equipment were my ears and the receiver's S-meter.

The Butterfly stood up very well to the test. It out performed the vertical and in most cases heard better than the dipole. It always put out better than either. For general use on 20/15/10 meters, I feel it's an acceptable substitute for the full-size tribander.

Observations

The Butterfly has very good front-to-back and front-to-side action. There's not a great deal of difference between its performance and the tribander's. On 20 meters, the three-element antenna consistently "talked" better than the Butterfly. The little antenna is only rated at +3 dB forward gain on this band. It's better on 15 and 10 meters at +5 dB. The full size antenna gets about 8 dB.

I didn't crush any rocks, but I did make every contact I set out to get. Maybe it's not the biggest gun in the pileups, but with a little patience, I got through. I highly recommend it for general 20/15/10 meter use. A ham can also use the Butterfly on 12 and 17 meters (as a dipole).

The small size of the antenna lets it hide well on the small push-up mast. No eyesore for the neighbors to complain about. Furthermore, it turns well even on an inexpensive Radio Shack rotor.

Initial adjustments were quite temperamental, but need be done only once.

Comments

A Butterfly installation like mine, or one with a roof mounted tripod, will usually not require a building permit or inspection. This saves money and avoids hassles with the local government.

The Butterfly is built as a compromise antenna, but it compromises the least of the typical small-space antennas. I estimate a Butterfly can be put up for about $325 using either a push-up mast or a roof tripod and a TV rotor.

If you want to crush rocks, you'll have to get a 5-element single band yagi and put it up at 100 feet. Of course, this will cost you more money than the Butterfly installation. Considering the good overall performance, the low initial cost, the lightweight hardware (mast and rotor), and the near invisibility, the Butterfly is a very good choice for a limited-space HF beam.

Specifications

Wingspan:	12.5 ft., 6 in.
Boom Length:	6 ft.
Turning Radius:	6.94 ft.
Vertical Spreaders:	6 ft.
Surface Area:	3 sq. ft.
Wind Survival:	80 mph
Power Rating:	1200 watts PEP
Bandwidth:	10 meters 1.5 MHz
	12 meters all
	15 meters all
	17 meters all
	20 meters 200 kHz
VSWR at Resonance:	1.5:1 or less
Gain:	10 meters +5 dB
	15 meters +5 dB
	17 meters 0 dB (used as dipole)
	20 meters +3 dB
Front-to-Back:	up to 20 dB
Front-to-Side:	up to 30 dB
Mast Size:	up to 1.5 in dia.
Hardware:	stainless steel
Feedline:	50 Ω nominal

Balloon-Supported Antennas for HF

How to really get out on 80 and 160 meters

by Stan Gibilisco W1GV

The idea of using a helium-filled balloon as a support for an antenna is certainly not new, but it is rarely done. Contrary to many ham's opinions, however, flying a "balloon vertical" or "balloon sloper" need not threaten either the pocketbook or human lives.

Initial Considerations

Certain things were obvious right from the beginning when I made my plans to fly a ⅝-wave end-fed antenna for 160 meters. The materials must be readily obtainable. The wire must be lightweight, conductive, and strong. There should be some provision for keeping the balloon from taking the antenna away. This last item is quite important because a long conductor, trailing from a large, lighter-than-air balloon, can be a hazard. It will eventually come down—perhaps draping the antenna over a power line.

The balloon itself has to be large enough to lift the antenna and to keep it up in a moderate breeze. I found 40-inch (about 1-meter) balloons for a few dollars that worked well for winds up to about 20 miles per hour and antenna lengths up to about 500 feet which used A.W.G. #20 (0.030-inch or 0.762-millimeter) aluminum welding wire. At higher wind speeds, stability was poor and several balloons plunged into tree branches and popped. Future plans include kite/balloon combinations to allow greater flight stability in higher winds, wind shear, gusting, and down drafts.

The most important consideration is: don't attempt balloon flight when there's any chance that the wire will hit a power line. Fortunately, I live in a neighborhood where most of the utility lines are underground. The nearest above-ground power lines are over 950 feet (290 meters) away. Allow a few percent for error in estimating the distance to a power line. I set the upper limit of my system to 900 feet (about 275 meters)—still more than a full wavelength at 1.8 MHz.

The antenna doesn't have to be any particular length, although it's best to choose a length near an integral multiple of ½ wavelength. At these lengths, the resistive component of the impedance is high, minimizing ground losses. In Figure 1, the variation of complex antenna impedance, end-fed over perfectly conducting ground, is shown for vertical antennas for increasing height. At heights less than ¼ wavelength, (the graph curve up to point A), the resistive component is extremely low. As the height increases beyond ¼ wavelength, where the resistance is about 37 Ωs, the resistance continues to increase. It reaches a maximum at ½ wavelength (at point B) of perhaps 600 to 800 Ωs. With a thin wire, the value will be very high, resulting in low ground losses with even a marginal grounding system. Matching techniques for ½-wave radiators are well known. Figure 2 shows two popular matching devices—the quarter-wave section of open-wire line and the tuned tank circuit.

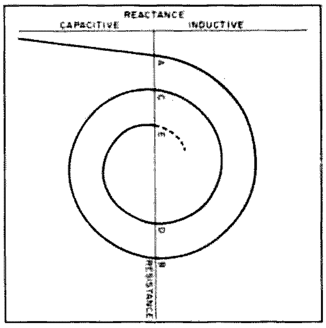


Figure 1. Reactance/Resistance relationship for an antenna from 0 to 1¼ wavelength high (point E).

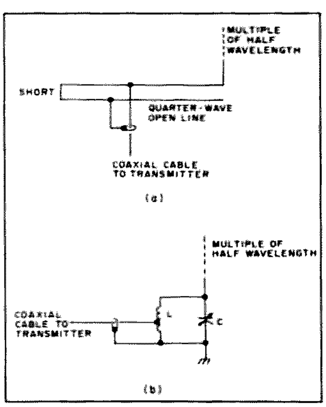


Figure 2. Two common matching systems for the balloon antenna.

Refer again to Figure 1. As the antenna length increases beyond ½ wavelength, the resistance decreases again, and reaches a minimum at ¾ wavelength (point C). This value is somewhat higher than the value at ¼ wavelength because of the extra resistance that occurs from radiation. Further increasing the height makes the resistance rise again, where it reaches another maximum at 1 wavelength (point D). Because of radiation, this value is less than the value at ½ wavelength. Continuing the increase in height produces a characteristic converging spiral in the complex R + jX plane, centered around a point on the R axis at about 180 + jO. It can be seen that the reactance alternates between capacitive and inductive, being zero whenever the antenna has a height that is an integral multiple of ¼ wavelength.

If a balloon-supported antenna is perfectly vertical, ideal heights for omnidirectional low-angle radiation are in the range of ½ to ⅝ wavelength. At 1.810 MHz, ½ wavelength is represented by 259 feet (78.8 meters) and ⅝ wavelength by 323 feet (98.5 meters). These lengths are determined by the formulas:

$L_{0.5\lambda}$ (feet) = 468/f MHz
$L_{0.5\lambda}$ (meters) = 143/f MHz
$L_{0.625\lambda}$ (feet) = 585/f MHz
$L_{0.625\lambda}$ (meters) = 178/f MHz

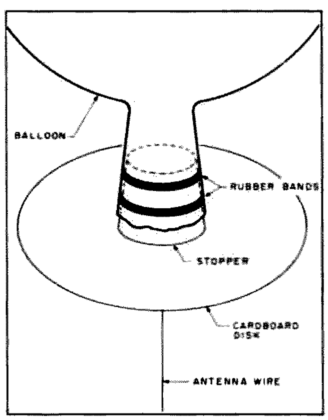


Figure 3. Stoppering the balloon after inflation. The cardboard disk acts to stabilize the balloon in winds.

Antennas supported by balloons, however, are rarely straight up and down. Even a slight wind produces considerable slanting of the antenna. If the wind is sustained over 20 miles per hour, it becomes difficult to keep a balloon antenna from breaking apart or coming down in a gust. My experience is that long wires supported by small balloons

almost always are "slopers," not verticals. Therefore, for low-angle directional propagation, lengths greater than ⅝ wavelength become quite practical and useful. To date I have flown lengths up to 830 feet (253 meters), representing about 1.6 wavelengths at 1.810 MHz.

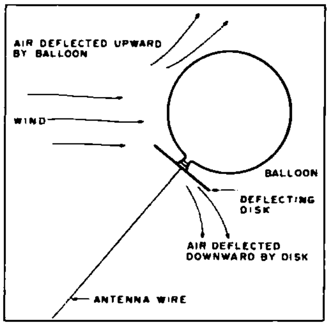


Figure 4. How the cardboard disk stabilizer serves to stabilize the balloon in winds. The upward force from the disk balances the downward vector caused by air flowing around the balloon itself.

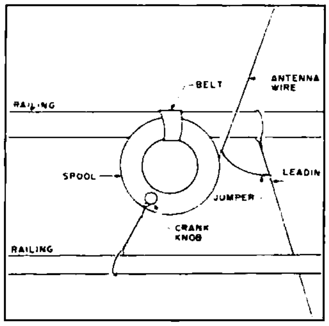


Figure 5. Base mounting scheme for the balloon antenna.

The Basic Design

The components for the basic balloon antenna cost under $100. I left out the costs of the antenna tuner—a fundamental component for a system like this—and the ground radial system, which you should consider installing. Several radials of ¼ wavelength or greater, laid on or just under the ground, minimizes ground losses and optimizes antenna performance. Such a system also reduces RF in the shack.

The original motivation for this experiment was the 1988 CQ Worldwide 160-meter CW DX contest. I planned to fly a ⅝-wave antenna for 1.810 MHz. The wire was A.W.G. #20 (actually specified at 0.030 inch diameter) hard aluminum welding wire, uninsulated, single-strand. The height was trimmed by adjusting for minimum SWR at 3.620 MHz, the second-harmonic where the antenna would be 5/4-wave resonant and present a fairly good match to 50 Ωs (it turned out to be 1.2:1). A 110-yard (about 100-meter) roll of 20-pound monofilament fishing line was run out along with the wire to act as a backup if the wire broke. This gave a good indication of the initial length of the wire, and ensured that the antenna really was being tuned for 5/4 wavelength at 3.620 MHz and not ¾ or 7/4 wavelength.

It was necessary to trim about 20 feet (6 meters) off the line for resonance, and this seemed about right since the lead-in to the shack was 15 feet (5 meters) from the base of the antenna.

The balloon, a 40-inch display balloon, proved to be unstable in even a slight wind, so a stabilizer was added by tracing a cardboard disk around a 33⅓-rpm phonograph record and placing it at the base of the balloon as shown in Figure 3. This device acts to deflect air downward when the balloon slopes in a wind. The balloon is thereby stabilized at the angle where the upward force from the disk balances the downward vector caused by air flowing around the balloon itself (Figure 4). This results in substantial improvement in stability, with much less bobbing and dipping, and a diminished threat of the antenna coming down because of a catastrophe with a tree branch.

Even with the stabilizer, I don't recommend flying the balloon in a wind of more than 20 miles per hour sustained, as the balloon may come off the end of the wire. Two balloons were lost this way, one prior to the contest and another after one hour, nine minutes of operation at the 77th contact. At this point, the stable antenna, an 880-foot (270-meter) longwire, was used. It's always a good idea to have such a backup antenna when a balloon antenna is used, so there is something to fall back on if conditions become too adverse for balloon flight.

I wound the wire, along with the fishing line, onto a spool intended for utility cords. The spool provided about 18 inches (perhaps 50 cm) of length per turn and made it easy to retrieve the wire without tangling. The spool was anchored to the railing of the sundeck with a pants' belt. A wire wrapped around the railing and tied to the crank knob of the spool provided additional anchoring. The wire to the shack was clipped to the antenna wire with an alligator clip. The whole base-mounting scheme is shown in Figure 5.

Of course, you don't need to watch the balloon to know a catastrophe occurred with the system. When the wire came down shortly after the contest began, the linear let me know right away by emitting a profoundly disgusted hiss. Signals dropped off to almost nothing. The SWR on the antenna tuner skyrocketed and all operations were momentarily suspended. Conditions improved the second night of the contest.

Inflation Process

The balloons I used had necks that fit directly over the helium tank valve, without the need for a special nozzle. Rubber bands secured the balloon to the valve. Inflation was done in the garage with the door down to keep air currents to a minimum, with the cars outside and the ceiling lights off.

Take care to keep the balloon away from sharp objects like hanging shovels, rakes and brooms. I inflated the balloon slowly to keep it from blowing off the tank, and so I would not accidentally overinflate and pop it. When the balloon was properly inflated, I pinched the neck and put the stopper in it, securing the neck tightly around the stopper with rubber bands. The balloon was then tethered to a short string, using the screw hook in the stopper, and the other end of the string was tied to a 5-pound dumbbell. It is surprising how much weight a balloon this size can lift. It took a medium-sized hammer up! Be sure to use sufficient securing weight.

Bringing the balloon outside requires a tight grip on the base of the balloon as well as on the dumbbell or whatever weight is used. Slight gusts of wind will send the balloon into wild gyrations and it could easily hit a twig or the corner of the eaves and pop. As soon as the antenna wire is connected to the base of the balloon, the balloon should be let up so that it will be out of the way of the roof or low trees. Stability improves when the balloon is clear of objects that create wind turbulence. It should not be left at great heights unattended or for long periods during the daylight hours, as a mishap can occur and neighbors might get inquisitive (along with half the country if the balloon is high enough).

Determining The Best Height

This kind of antenna is especially useful on 80 or 160 meters. Normally the ⅝-wave height is best for all-around use. The length can be measured by determining the circumference of the spool, with the wire fully wound on it, and then counting the turns by feeling the knob thumping on your hand. It is important to add the length of the lead-in when determining antenna length. Don't expect exact resonance—a ⅝-wave radiator is nonresonant anyway. The reactance is tuned out by the transmatch at the station.

It's sometimes desirable to use heights greater than ⅝ wavelength. When this is done, precautions must be taken to ensure that the antenna cannot fall on a power line. There is increased risk of such problems as the wire coming down on television antennas, neighbors' cars, houses, and such things. The slope and tension will increase as the balloon is flown higher. The aluminum welding wire that I used, about A.W.G. #20, gives approximately 1200 feet (366 meters) per pound. This can be lifted by the balloon I chose, and is about as long as any wire that any ham is likely to want to use. The length of the wire will determine the cones of maximum radiation around the antenna. As the wire is made longer, the cones become sharper—that is, the angle of the apex decreases. Minor lobes also appear. A complete discussion of this subject would require a long article or book chapter all by itself, and there is simply not space here for it. Longwire antennas are discussed in *The ARRL Antenna Book*, where detailed illustrations of the maxima are given.

Considering that the maximum length of a balloon antenna is two wavelengths at 160 meters, there will not be appreciable gain resulting from the major lobes of a longwire of this size. There will be excellent low-angle radiation in some directions, however, and it may be expected that these maxima will provide superior low-angle radiation compared with any other kind of 160-meter antenna available to most amateurs. For example, a 1.5-wavelength wire at 1.810 MHz will

measure 777 feet (236 meters) and will have maxima in a double cone with apex angle about 43 degrees, and also in the plane perpendicular to the wire. If this wire flies at an angle of 43 degrees up from the horizon with a wind from the north, there will be low-angle maxima toward the North and South, and also toward the East and West (Figure 6). These result from phasing at quite high locations above the ground and will be essentially the same as if the antenna were in free space. There will be radiation at somewhat elevated angles in various directions. The actual pattern is rather complicated, but with a bit of imagination you can envision the radiation pattern in three dimensions.

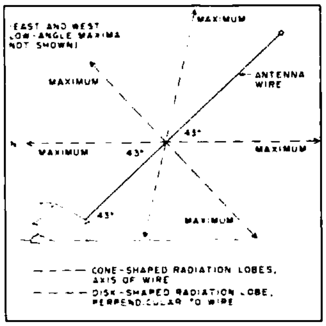


Figure 6. Radiation patterns for a 1.5 wavelength wire at 43° to the horizon. This is an excellent low-angle radiator.

We have no control over the wind direction, but we can change the length of the wire and obtain maxima at low angles in any desired direction, no matter what the wind direction. Winds do change frequently, though, and if you get very serious about balloon antenna operation you may find yourself listening to NOAA Weather Radio quite a lot. It's helpful to know when to reel in the balloon!

Again, don't forget to tether the balloon with fishing line along with the wire, so that the balloon will not be likely to take the wire with it if there is an accident.

The Impermanence of It

I have wondered why this kind of antenna is not used more often by enthusiasts of 1.8 and 3.5 MHz, and I think I have some idea. First, and quite legitimately, many hams are in areas where this kind of project is impractical and perhaps even dangerous. A trip to the country, QRP style, is an alternative in these cases. You may want to try this for Field Day on 80 meters and possibly even 40 meters. It's worth a try from a temporary location. Don't do anything that might endanger your life or someone else's life by trying this near power lines, however.

Second, this kind of antenna seems impermanent, flimsy, and even "hokey" to some because it may be brought down by mischievous winds or birds, and because it is subject to so many variables. It may even seem like cheating to use a balloon support. But it *works*. The loss rate is considerable no matter what you do, but it's still fun while it lasts.

On The Air

The first thing I noticed when I flew my first balloon—a ⅝-wave 160-meter slanting vertical—was noise. It is evidently no misconception that a wideband vertical will pick up tremendous amounts of noise, often S-9. Signals were often as high as S-9 + 30, while on my 880-foot (270-meter) longwire the signals were rarely of that caliber. Even so, it was often true that signals were readable on the longwire, with noise levels of S-2 or S-3, which weren't readable on the vertical. I therefore set up an arrangement with a separate receiver so that I could listen on the longwire while transmitting on the balloon-supported antenna.

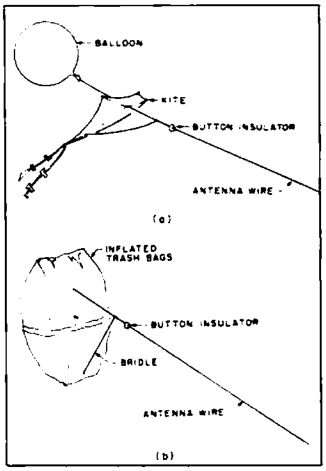


Figure 7. Several balloon antenna arrangements.

Results were immediately gratifying. I tuned up to 500 watts CW output, the most power I dared to use on that thin wire. Signal reports were quite routinely S-9-plus. It wasn't unusual to hear any report less than 589. I did not work any DX, except for the Virgin Islands, Puerto Rico and Alaska, but this is probably because I didn't have the appropriate system of beverage antennas that is best for hearing DX at 1.8 MHz. On 80 meters I easily worked JA stations, hearing somewhat better on that band with the balloon vertical since the noise level was a little more reasonable.

In the contest, stations that are well known for holding frequencies, were calling *me*. That meant the thing was getting out, even when it was flying at an angle of 35 to 45 degrees above the horizon. I used 12 radials laid under the snow, each ¼ wavelength long at 1.8 MHz. When W0AIH answered me during a run, I knew I was doing something right!

I noticed some static buildup on the antenna while it was being put up. This should be expected. Avoid shock by not touching the ground wire or lead-in before the antenna has been connected. If it snows or rains, or if the wind gets too strong, the antenna should be reeled in. It's no fun to work in constant fear of a sudden load change.

Trial and error is part of any project, but I hope this article will help you avoid some of the more common problems involved in trying to fly balloon-supported antennas. More complex projects, such as balloon-supported wire quads for 160 meters, are in the back of my mind.

Future Designs

The main problem was the wind. It is not common for many locations to be windless or near windless in the wintertime. A plain balloon will be blown down by a wind of more than about 20 miles per hour. Kites would be better under such conditions, but there is no guarantee that a kite will stay up when conditions change. It would be ideal to have a device that would fly under conditions of no wind up to perhaps 30 or even 35 miles per hour. (Wind speeds greater than 35 miles per hour are unfavorable even for the best kites.) I have heard that there is a device called a Kytoon that will serve this purpose, but I would prefer to attempt to build my own at low cost, since these flying machines seem to have a propensity for getting lost or destroyed.

The stabilizer described here is a big help, but in a gusty wind, or a wind more than 20 miles per hour, the balloon still flies very low and may hit tree branches, and get snagged, or pop. It may be necessary to use a kite for relatively windy conditions and a balloon for less windy weather, but the goal is to make a single device that will stay up in a variety of weather conditions. One idea is to attach a balloon to a small kite. In this case, it's important that the balloon be able to lift the kite, and that the kite not break because of the added wind resistance caused by the balloon. It should also be ensured that the balloon will not be popped by a pointed part of the kite. Figure 7A shows one possible arrangement.

Another idea is to use a pair of garbage bags for the balloon or, alternatively, large plastic bags from a department store. Two of the bags could be taped together using wide plastic tape, such as is shown in Figure 7B. The joint could be sealed with acrylic spray and the gas put in a hole cut in a corner of the bag. It is of a shape that might be rigged to fly as a kite, especially if fins could be attached for stabilization.

I plan to keep working on balloon supports that are more reliable and that will stay up longer. The low bands are primarily wintertime DX bands, which is fine since there are no thunderstorms in many places during the winter.

Conclusions

I thought about putting up some sort of short vertical or inverted L and forgetting about the balloon idea altogether. Such thoughts come to me when another balloon gets away—it is staggering to realize how many different ways this can happen—but nothing outperforms the ultimate, no-compromise, full-size antenna for transmitting. I'll keep the short verticals, longwires and inverted Ls for use when conditions will not permit balloon flying, but in the next 160-meter contest, you can be pretty sure that if W1GV has a big signal, the antenna is a ⅝-wave balloon vertical or a longer balloon sloper!

73 Book Review

On the Road Again

Tips from the best in mobile HF

Reviewed by Larry Ledlow, Jr. NA5E

The Best of HF Mobileering:
A HF Mobile Antenna Compendium
by Don Johnson W6AAQ
Published by the Author
Box 595
Esparto, CA 95627
Price: $10

Small, full-featured HF transceivers seemingly make mobile operation a snap these days . . . that is, until it's time to consider a proper antenna installation. A half-wave dipole for 75m phone simply will not fit atop anything less than a four-trailer tandem "road train" like the Aussies use to carry goods through the outback. A quarter-wave whip for 40 meters? Good luck with the power lines, underpasses, and low flying aircraft. All kidding aside, mobile HF antenna installation requires serious planning to make the most of *very* restricted real estate. Don Johnson W6AAQ brings forty years of mobile experience within easy reach through his new compendium, which makes life much easier for the new generation of "mobileers."

The 116-page compendium emphasizes automobile HF antenna installations, but mariners will find some very worthwhile points to consider for their own requirements. The author, long recognized as an outstanding authority on HF mobile operations, combines the highlights of 40 years of ham mobileering taken from his own records as well as *3995 Mobileer Newsletter*, *73*, *QST*, and *CQ*. The result is simply wonderful.

Why 40 years of HF mobileering? Believe it or not, hams were not allowed mobile operation on 80, 40, or 20 meters until 15 July 1948. Along with a select few in other parts of the country, W6AAQ, W6NTU, and W6ZIG ushered in a new age of hamming by meeting on 3995 kHz just after midnight on that date. Shortly thereafter, the San Francisco Bay area group grew to more than a dozen, and informal meetings and equipment comparisons followed.

The 3995 Mobileers were born

W6AAQ begins his book with a brief history of HF mobile developments. Perhaps the old timers will remember Carter Modulation, named after Bob Carter W6NTU, that proved a much more efficient, two-tube AM transmitter than predecessors. This was just what mobileers needed. Early receivers were typically fixed-tuned converters fed into the autos' broadcast band receivers. By the early 1950s, the Gonset Super-6 tunable converter arrived on the mobile scene. With suitable modifications, the Gonset-6 could serve as a transceiver, but other equipment soon displaced it.

After his brief history of 3995 Mobileering experiences, the author moves quickly to pertinent points of mobile installation procedures and considerations. No doubt many readers will wince while reading page 8, which discusses the utility of certain devices for drilling holes in nice, shiny, new automobiles. (Don't worry, the first hole is always the hardest and most painful to drill. The rest come much more easily.) Discussions on safe power installations, coil homebrewing, multi-band antennas, field strength measurements, and much more, follow.

The second half of the book contains reprints of articles describing mobile antennas and tuners. Readers should find many of the pre-1960 ads of interest, too. Don't miss the SSB transmitter schematics dated 1954, either. Wayne Green fans will no doubt find interesting the review of the Gonset G-66 receiver. W2NSD was editor of *CQ* when that article was written (July 1956). How times change.

Don Johnson's book will help anyone, novice or expert, put together an efficient, top-notch HF mobile installation. Everyone—and I mean *everyone*—thinking about installing a mobile transceiver, from a 10m FM rig to a 100W SSB unit, should read this book. After nearly ten years of HF mobile experience, I can testify to the book's sensible approach to mobileering. I only wish Don had published *The Best of HF Mobileering* a decade ago. It would have saved me a lot of grief. 73

MARS AND AMATEUR RADIO

The Military Affiliated Radio System

by Gerard J. Scarano W1ZM, NNN0WAJ

"All stations this net-All stations this net-This is NNN0NBL establising the One Hotel 3 Bravo Navy Marine Corps MARS traffic net-This is a directed net-Are there any stations with traffic?-Over." This is the voice of the Military Affiliated Radio system's MARS operator at the United States Submarine Base in New London, Groton, Connecticut, amateur radio call K1SSN operating on 4007 kHz, Upper Side Band. This net is established daily at 1900 local time for handling incoming and outgoing Connecticut traffic. Other nets on different frequencies are in process throughout the world around the clock, passing traffic by voice, CW, RTTY or even Packet.

What and Why MARS

The Military Affiliated Radio System is a Department of Defense (DOD) sponsored program, established as a separately managed and operated program by the Army, Navy, and Air Force. This article addresses Navy-Marine Corps MARS only. It is composed of licensed US Amateur Radio Stations voluntarily participating and contributing to auxiliary communications locally, nationally, or internationally as an adjunct to normal Naval Communications. Such communications are available to Military, Civil, and Disaster Officials during emergencies. High on its list of priorities is handling morale and quasi-official record and voice communications for Armed Forces and Authorized US Government Civilian Personnel stationed throughout the world. In addition, MARS creates interest, and furnishes a means of training members in Naval Communication Procedures, thus providing a potential reserve of trained radio communications personnel for military duty.

History

The US Navy's association with amateur radio dates back to the very inception of the art of wireless communications. CW operators cut their teeth on the weather reports, time signals, and notices to Mariners emitting from the Navy Station, NAA in Arlington, Virginia, and commissioned in 1913. While with the Navy in Washington, DC, I lived on South Courthouse Road, in Arlington, Virginia, two blocks from what was then the three 500-foot towers of old NAA, and on the other side, two blocks away, was the active Army station WAR with its very impressive rhombics. "It was a pleasure to operate my ham rig W4JFM with a forty-foot vertical over the remnants of the old NAA counterpoise (radials), which were still embedded in the red clay of the Virginia soil. The combination turned out to be a pipeline to DX all over the world, with only 50 watts."

The US Navy didn't take long to realize the immense potential gain by forming a close relationship with amateur radio, and assumed a policy of encouragement and support toward the amateur fraternity. Within ten days of the US entry into World War I, on 7 April 1917, 500 of the then 6,000 US amateur radio operators were enlisted for duty in the US

Photo A. Code practice.

Photo B. Lieutenant Hund operating 2 meter packet.

Navy, and before the war was over, some 3,500 more amateurs joined one of the services. In World War II over 2,500 amateur radio operators served with the Armed Forces, and many thousands more assisted in industry and research.

On 17 August 1962, The Honorable Fred Korth, Secretary of the Navy, approved a plan to establish a Navy MARS on 1 January 1963. Following this, on 30 November 1968, the Department of Defense (DOD) issued a directive formalizing the composition, mission, and function of MARS, and set policies supporting both MARS and civil amateur radio activities. I became an official Navy MARS operator in May 1966, having been an Army MARS operator before World War II.

The DOD directive concurred in the mission statements outlined at the beginning of this article, and among other things, specified: 1) It shall be our policy in MARS to support and encourage MARS and amateur radio activity within the Department of the Navy and to avoid any action which would tend to jeopardize the independent prerogatives of the individual amateur radio operator. 2) In addition we shall recognize the technical and operating proficiencies inherent in the possession of a valid amateur radio license issued by the Federal Communication Commission or other competent US authority.

MARS at the US Submarine Base in New London, Groton, CT

It was based on these two policy statements that I, upon my retirement from the Navy Department in Washington, DC, accepted the job as Custodian of the MARS/Amateur Radio Station on base. The station was then under the control of Special Services, who at one time had provided much money to buy equipment, such as the Collins "S" line and KWM-2s. However, things had deteriorated so that little of this equipment was in operating condition. The station was placed under the control of the Base Telecommunications Department. Now we are able to comply with the DOD directive's mission statements and policies.

On 20 October 1987, Captain John Cox, Commanding Officer of the Submarine Base and an amateur radio operator himself, presided over a formal ribbon cutting ceremony. Today, with refurbished operating positions, the station flashes with the latest in electronic equipment, including computers, beams, and dipoles installed from 100-foot poles and towers. There is CW voice, RTTY, and packet capability on HF, VHF and UHF. Several frequencies can be covered at one time, including a station UHF repeater on military frequencies. The membership has been restricted to active and retired military and civil service personnel. Official meetings are held on Monday evenings, but it is not unusual to find members operating any time of the day or evening.

With all this support from the Navy, the next question is, "What has this station affiliated with MARS contributed to the program?" To start with, the station is still suffering from organizational growing pains which are slowly being overcome. However, on two occasions the station has solicited additional operators from the local Tri-City Radio Club and has, as a joint effort, featured two "Special Event" weekends celebrating the arrival of the first nuclear submarine, NAUTILUS, back to its home port in Groton, Connecticut for a memorial and the dedication of the NAUTILUS Memorial and Museum. Over 2,000 contacts were made on each occasion.

Photo C. Operations K1SSN NNN0NBL.

Photo D. Custodian Jerry Scarano tuning up RTTY.

Another event is planned for early autumn 1988. Drop Boxes have been placed in appropriate spots within the base for outgoing messages. These messages are put on the air daily. Code practice and technical classes are being run weekly for those desiring to obtain an amateur license or to upgrade their license. In addition, special classes are being run for the local Sea Cadets. Periodically, FCC examinations are given. A special request is in process to handle "At Sea Traffic." Messages go from "SEND MONEY" to "MORALE BUILDING" between service persons and their families. Deaths and serious illnesses are referred to the Red Cross as a matter of policy. When not operating, special facilities are available for equipment repairs or experimental construction. Vistors are always welcome.

Eligibility to Join and Benefits to Gain

Eligibility for membership in the MARS program is restricted to the following:

1) Must be 14 years of age or older.
2) Must be a US Citizen or resident alien.
3) Must possess a valid amateur radio license issued by the FCC or other competent US Authority.
4) Must possess a station capable of operating on MARS HF frequencies. (Most commerical equipment will hit these frequencies, or will with a slight modification.)

In addition, MARS members must agree to operate in accordance with the rules and regulations governing MARS. In Navy MARS a minimum of 18 hours per calendar quarter, with 12 of the 18 hours being on Area or Region HF networks, is required.

The benefits are numerous, but the most outstanding follow:

1) Membership adds to the enjoyment of your amateur radio hobby.
2) You become part of the Navy-Marine Corps' worldwide communication system.
3) You increase your communication skills and capabilities.
4) You have may select correspondence courses in communications and electronics from MARS free as soon as you have completed six months of active membership.
5) You can operate on specially assigned military radio frequencies.
6) You will join a group of dedicated fellow radio amateurs who are participating in a meaningful public service.
7) You will gain a feeling of being associated with a military mission and of contributing to the welfare and preparedness of the nation.
8) You will be operating in regulated, disciplined radio nets with specific operating rules.
9) You will participate in the MARS Excess/Surplus Equipment Program as soon as you have served six months of active membership. Issue of equipment is based on availability.

Where To Apply

You may join Navy MARS by sending your request for application forms to:

Chief Navy-Marine Corps MARS
4401 Massachusetts Ave. NW
Washington DC 20390-5290

They will process your request through your local MARS coordinator. Good Luck and Welcome Aboard.

AUTO VIM: PART 2

Part II: Smart power supply for every bench

by L.B. Cebik W4RNL

Current Monitor

Although voltage monitoring circuits are growing more common in bench supplies, there's still little useful current monitoring. A single meter for gross current measurement provides little help for monitoring low current circuits, while a sensitive meter pegs long before the supply nears its maximum rated output. Automatic monitoring of both positive and negative current drain appears only in expensive industrial and lab equipment in the $2,500-and-up class. A simple, reliable, and effective current monitoring circuit, however, has long had a place in the data books.

The current monitor in Auto-VIM owes much to National Semiconductor's Linear Databook circuit for routinely converting current drain to a voltage output without resorting to ultra-precise resistor matching.

The sensor circuits in Figure 4 use different op amps to sense positive and negative current flow. The TL081 (or LF351) Bi-FET op amp uses P-channel inputs which work with input voltages close to the positive supply value, but fail as the input voltage approaches the negative supply voltage. By contrast, the newer TI NFET op amp, the TL091, with its N-channel inputs, shows precisely the opposite characteristics. Between the two, we obtain separate but parallel sensors for positive and negative supply currents.

The transistors, whose base current is controlled by the op amp output, control the voltage seen at the 3.3kΩ resistor. In fact, the circuits provide an output voltage per mA of line current equal to .001 times the product of R1 and R3 divided by R2. The circuit shown provides .0033V per mA, or 1.65V at 500 mA. Sensor circuit output is positive for the TL081/2N3904 combination and negative for the TL091/2N3906 duo. Although most data book circuits show FETs rather than transistors used with the FET input op amps, the bipolar transistors work better at the 5V end of the power supply range. Note the 10-turn trimmer pots marked Rb, which will receive attention during circuit calibration.

A DC amplifier follows each sensor to increase the voltage to a level desired for measurement. As with the voltage monitor, the negative amplifier inverts while the positive does not, thus yielding positive voltages for the bilateral switch. Each amplifier has a gain of 6.7 so that the metering circuit will see 12V at 500 mA, which is within the linear range of the op amps and within the switching range of the 4066. Each section of the LF353 includes an offset balancing circuit to decrease errors introduced by remnant voltage outputs.

The 4066 bilateral switch operates just as in the voltage monitor, switching in time with the positive and negative readings according to the signals from the flip-flop. One section performs another chore, that of shorting and unshorting part of the meter resistor chain as the current rises above or falls below 50 mA at the sensors. A section of a 339 comparator causes the output to change whenever the inverting input passes 1.2V. The resistor chain includes separate calibration trimmers, Rm, for each range. A 50 mA meter from Radio Shack with an internal resistance of about 2150Ω forms the base from which the other resistor values were calculated. The 1N914 and the 1.5V Zener provide meter protection.

Two of the remaining 339 sections control indicator lights which tell the user which range the meter uses. With the values shown, the circuit flips to the high range just as the needle passes the 50 mA mark, and returns at about 45 mA. The difference derives from the introduction of a small amount of hysteresis (the 5MΩ feedback resistor) to obtain good switching action with slowly changing voltages. The circuit is more than fast enough to protect itself when going from nearly no current on one polarity to nearly full current on the other. It's much faster than any mechanical or heating effects upon the meter.

Output for a digital voltmeter emerges directly from pins 4 and 1 of the 4066. If the digital meter has a three or three and a half figure readout, the builder can omit the autoranging feature and the indicator lights. This option permits using one 4066 for both monitors, since each 4066 has four independent switches per package. Set the gain of the DC amplifiers to a level giving the desired voltage per mA for the digital metering circuitry.

As with the voltage monitor, construction is not critical, and the parts fit on a 3 x 3 ½-inch perfboard backed against the voltage monitor board with four ¾ inch pillars. The squeeze is a bit tighter due to the larger sensor resistors (.22Ω at 3 watts) and the number of trimmers. Again, be sure all trimmers are accessible for later adjustment.

Calibrate the current monitor in sections, starting with the sensors. In fact, I added input and output pins for the sensors and DC amplifiers (shown as small circles in Figure 4), only connecting them together after initial adjustments. The TL081/091 op amps require careful balancing, hence the use of 10 turn pots.

Circuit output with no current load on the supply will go to zero and jump to a few volts of the opposite polarity. Set the value as close to zero as possible. Check the balance across

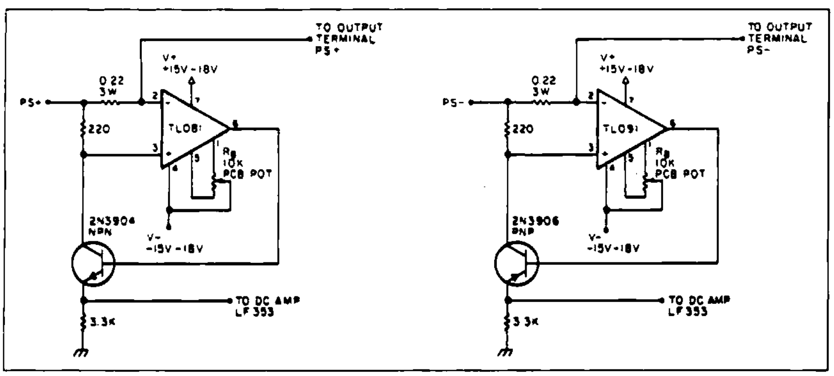


Figure 5. Schematic of the current sensors powered from the fixed supplies.

the full power range, as the remnant voltage will vary according to how well the positive and negative lines track each other. Be sure it never changes polarity for any voltage in the power supply range. Figure 5 shows a slight variation in the sensor circuits, with op amp power derived from the fixed supply. This method yields lesser remnant voltages as the power supply changes voltage, but is limited by the fact that the fixed supply and the upper limits of the variable supply are so close together. The sensor goes nonlinear as the variable supply approaches the fixed supply.

For this circuit, an 18V dual fixed supply for the sensor circuits would be ideal, although this value would exceed the limits on the CMOS chips. Hence, for the bench supply shown, powering the TL081/091 sensors from the variable supply provided more accurate readings, with a maximum remnant reading of under 2 mA at the meter.

Separately balance the DC amplifiers by grounding their input resistors and adjusting the balance trimmers, Rb, for no output. Connect the sensor outputs and adjust the gain of each amplifier, using some standard high wattage resistors to set calculable loads. A 1000Ω, 5W resistor, for example, will provide a load of 5 mA at 5V, 10 mA at 10V, and 15 mA at 15V, while a 250Ω, 5W resistor will quadruple all values. Set the comparator trimmer, Rt, for an input of about 1.2V.

Using a small load, adjust the 2kΩ meter trimmer for accurate reading at or near full scale. Using a larger load (just being sure that the meter shifts from the 50 to 500 mA scale), adjust the 20kΩ meter trimmer for accurate readings. Now monitor changing loads to be sure the meter shifts range as desired, and check that the LEDs indicate the proper range.

Although the calibration procedure is somewhat complex as such things go, it permits the building of an auto-polarity, autoranging circuit with common, inexpensive components. In my view, spending ham time instead of family money makes good sense.

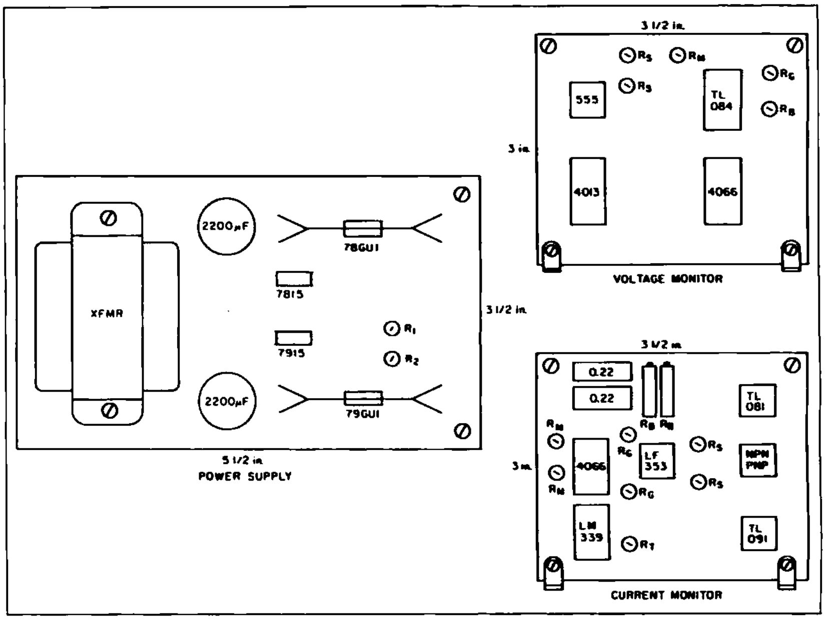


Figure 6. Board layout sketches for AUTO-VIM.

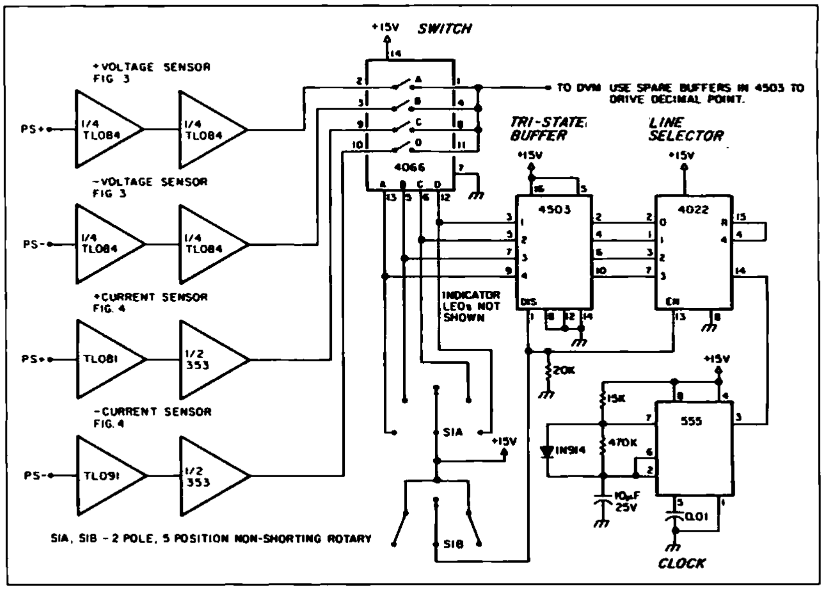


Figure 7. Schematic diagram of a one meter (DVM) auto-polarity voltage and current monitor.

Final Assembly

The entire supply and control circuitry fits into a cabinet 3 inches high by 5 inches deep by 8 inches wide. All controls, fit on the front panel. The fit is close, but more than adequate. The meters obviously take up the most space. For convenience, even the fuse has its front panel space.

Between the front panel and the boards, there is about an inch and a half of space for panel components and their leads. This eases final assembly, which requires a considerable number of connections to the panel and from one board to another. For low current connections, I used ribbon cable for ease of handling and the built-in color coding that reduces wiring errors. Wherever possible, I connected one end of each wire set before final assembly, taking careful notes on which color wire connected to which other terminal.

The power supply section mounts horizontally on half-inch pillars, and occupies most of the cabinet space. The monitor boards mount vertically back-to-back, separated by pillars and fastened to the case bottom with L-brackets. This technique saves space and permits easy dismounting for circuit experiments. In fact, the photos show the supply just before alteration of the voltage monitor to the circuit shown in Figure 3. To supplement the photographs, Figure 6 sketches the general layout of each board. Since construction is so non-critical electronically, any convenient arrangement should work as well as the one shown.

A One-Meter Monitor

For some applications, a single meter may satisfy monitoring requirements. A digital voltmeter might well do voltage and current duty on a regularly cycled basis if there is a provision for manual override. A single meter permits some circuitry simplifications through a slight change of technique.

Figure 7 shows a one-meter monitor that automatically switches through both positive and negative voltage and positive and negative current readings. The 555 or 7555 clock feeds a 4022 one-of-eight selector wired for one-of-four use. Since the chip not only has eight control lines, but can be sequenced to others as well, cyclical monitoring over many values becomes easy. Connecting the fifth output (or the one after the last one used) to the reset line gives instantaneous return to the first line, restarting the cycle without interruption.

To permit manual override, the signals

from the selector pass through a tri-state buffer, the 4503. Normally, the selector enable pin (13) and the buffer disable pin (1) are at ground (through a 20kΩ resistor). Under these conditions, the meter cycles automatically. The two-pole, five-position non-shorting rotary switch establishes these conditions in its center position. At any other position, the disable and enable pins go High, interrupting the cycle. The switch also sends the desired 4066 switch control pin High, thus holding the meter on this reading until the switch is returned to the center position. The 4503 outputs will also support indicator LEDs with 1.5kΩ series resistors without further buffering.

The sensors appear only in outline form, since they are identical to those in Figures 3 and 4. Since the TL084 and the LF353 are quad and dual op amp versions of functionally the same circuitry, one can interchange positions for all but the two current input sensors. For this application, separate DC amplifiers for each of the voltage sensors are preferable, since they permit separate calibration of both positive and negative voltage monitors. The 4066 output can drive any analog or digital meter. The only necessary variations will be in amplifier gains to supply acceptable signal levels to the metering circuits.

The monitoring circuits we have looked at are expandable in many directions to serve a large number of monitoring needs. Adding current monitoring to the more common voltage monitoring provides an especially helpful dimension to the average bench supply in the ham shack. Since the whole supply should cost no more than about fifty dollars, including a case and two meters (almost half the cost), there's no good reason why every ham shack should not have a supply with all the benefits of automatic voltage and current monitoring. AUTO-VIM will certainly earn its keep. Having used it for only a few months, I have already recovered its cost in parts I did not burn up. I can now spot trouble before my nose tells me it is too late. ■

[Part 1, including Figures 1–4, was published in the August issue.]

PARTS LIST

Dual Power Supply

Quantity	Part	Source
1	18V, 2 amp transformer	All Electronics
1	½ amp fuse and holder	RS 270-364
1	SPST toggle switch	RS 275-662
1	Line cord	
6	1N4001 50 PIV diode	RS 276-1101
1	78GU1 variable positive voltage regulator	Circuit Specialists
1	79GU1 variable negative voltage regulator	Circuit Specialists
1	7815 +15V regulator	Circuit Specialists
1	7915 −15V regulator	Circuit Specialists
2	2200 µF, 35V electrolytic capacitor	RS 272-1020
2	.1 µF, 35V tantalum capacitor	Digi-Key
1	.22 pF, 35V tantalum capacitor	Digi-Key
2	1 µF, 35V tantalum capacitor	Digi-Key
1	2.2 µF, 35V tantalum capacitor	Digi-Key
1	2 section linear potentiometer, 10kΩ /section	Circuit Specialists
2	500 Ω PC board trimmer pot	Digi-Key
2	1.5kΩ, ¼W resistor	
1	2kΩ, ¼W resistor	
1	4.2kΩ, ¼W resistor	
2	4.7kΩ, ¼W resistor	
2	5.6kΩ, ¼W resistor	
1	LED and panel mount	Jameco
2	Heatsinks for TO-202/TO-220 cases	Digi-Key
1	Cabinet: 3 ½ x 7 ¼ x 5 ¾ inches	RS 270-269
	Perfboenl	
	Mounting posts and hardware	
	T46 or similar connection pins	

Voltage Monitor Parts

No.	Pert	Source
1	TL084 quad BiFET op amp	RS 276-1714
1	4066 bilateral switch	Digi-Key
1	4013 dual D-type flip-flop	Digi-Key
1	555 or 7555 (CMOS) timer	Digi-Key
1	0 to 15 voltmeter with external series resistor	RS 270-1754
3	.01 µF, 50V disc capacitors	Jameco
1	2kΩPC board trimmer pot	Digi-Key
2	10kΩPC board trimmer pot	Digi-Key
2	100kΩPC board trimmer pot	Digi-Key
1	100 Ω, ¼W resistor	
2	1kΩ, ¼W resistor	
1	9.1kΩ, ¼W resistor	
3	15kΩ, ¼W resistor	
2	20kΩ, ¼W resistor	
2	75kΩ, ¼W resistor	
6	100kΩ, ¼W resistor	
1	150kΩ, ¼W resistor	
1	470kΩ, ¼W resistor	
2	LED and panel mount	Jameco
1	SPDT Center off toggle switch	RS 275-664
1	8 pin DIP socket	
3	14 pin DIP socket	
-	Perfboard	
-	Posts and hardware	
-	T48 connection pins	
-	Ribbon cable	

Current Monitor Parts

No.	Part	Source
1	TL061 P-channel BiFET op amp	RS 276-1716
1	TL081 N-channel NFET op amp	RS 276-1745
1	LF353 dual BiFET op amp	RS 276-1715
	4066 bilateral switch	Digi-Key
1	LM339 quad comparator	RS 276-1712
1	2N3904 NPN transistor or equivalent	RS 276-1603
1	2N3906 PNP transistor or equivalent	RS 278-1604
1	1N914 silicon diode	RS 276-1122
1	1.5V Zener diode	Digi-Key
1	50 microammeter	RS 270-1751
1	5kΩ PC board trimmer pot	Digi-Key
1	10kΩ PC board trimmer pot	Digi-Key
2	10kΩ, 10 turn trimmer pot	Jameco
1	20kΩ PC board trimmer pot	Digi-Key
4	100kΩ PC board trimmer pot	Digi-Key
2	.22 Ω, 3W 5% resistor	All Electronics
2	100 Ω, ¼W resistor	
2	220 Ω, ¼W resistor	
2	1.5kΩ, ¼W resistor	
2	3.3kΩ, ¼W resistor	
1	7.5kΩ, ¼W resistor	
3	10kΩ, ¼W resistor	
1	20kΩ, ¼W resistor	
1	91kΩ, ¼W resistor	
10	100kΩ, ¼W resistor	
1	220kΩ, ¼W resistor	
1	510kΩ, ¼W resistor	
1	620kΩ, ¼W resistor	
1	5 MΩ, ¼W resistor	
4	8 pin DIP sockets	
2	14 pin DIP sockets	
	Perfboard	
	Posts and hardware	
	T46 connection pins	
	Ribbon cable	

Number 11 on your Feedback card

THE PEE WEE THIRTY TRANSCEIVER

'A compact 30 meter CW/AM QRP transceiver (Part I)

by Dan Eggert AC9E

The one thing about amateur radio I've always liked best was the challenge of building my own equipment. Here's a little 30 meter QRP transceiver that has certainly brought a lot of fun back into amateur radio for me lately, and I hope to share some of the fun with you!

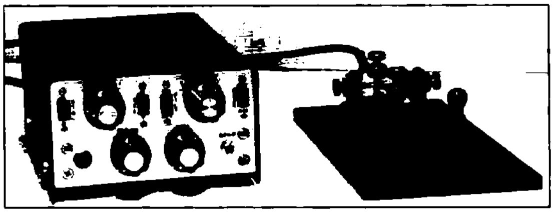


Photo A. The 30 meter Pee Wee transceiver and keyer.

My family goes camping nearly every weekend possible during the warmer Wisconsin months, and I thought that it would be great to have a portable rig to set up at the campsite. The 30 meter band appealed to me since I prefer CW, and the barefoot restriction on the band makes it attractive for QRP operation. I have since designed 40 and 20 meter versions, details of which I will gladly provide for an SASE.

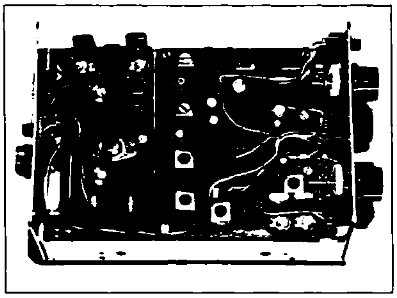


Photo B. The internal view of the QRP transceiver.

My first unit was built on a perf board, it was only one frequency, and it did not have a CW filter. After the first few QSOs, I decided the receiver needed some sort of CW filter, so I built a two-stage audio active filter on a seperate small perf board and stuffed it into the rig where I could find some room. I'm embarrassed to show anyone the inside of my first unit, because it was a real rat's-nest of modifications. It performed very well, however, and I was very surprised at what a couple of watts of output power can do! After several comments on the transmitter's signal quality, and some requests for construction plans, I then designed a printed circuit board and cleaned up the rat's nest!

The rig is very simple and a bit of a challenge to operate, especially for those accustomed to all the automation of big rigs. The receiver is quite sensitive, but it only has a manual gain control, and a simple two stage 800 Hz CW audio filter. The transmitter and receiver are crystal-controlled for stability, but the receiver is also tunable, so the rig can double as a WWV monitor.

Simple, Inexpensive Design

The transmitter and receiver can be built separately, because they don't share components. They are actually two separate circuit boards joined together. The builder can put together the receiver alone as a WWV monitor, or for some other specific frequency.

I made a special effort to keep things simple and inexpensive. I also tried hard to avoid the coil winding, to keep from discouraging some project builders. With some experimentation, I found that 10.7 MHz IF transformers in the RF preamp and oscillator circuits of the receiver worked adequately at 10.1 MHz. All transformers used in the receiver were inexpensive and readily available from Mouser Electronics. The transmitter has a transformer and coil that have to be wound, but they are simple to build (see construction notes).

The side tone during transmit is obtained by leaving the receiver on and lowering its gain by removing power to the preamp and gain control potentiometer. A great way to monitor your own signal! When the rig's NiCds start to die, I hear a sudden slide in the side tone frequency. A loose connection in the antenna or feed line shows up as an abrupt shift in side tone frequency and/or amplitude due to a load change.

Except for the audio output stage, the receiver's circuit designs come from the 1977 *Radio Amateur's Handbook*. It's a single conversion superhet with a 455 kHz IF. It has two local oscillators, a two-frequency, crystal local oscillator, and a tunable local oscillator. The oscillators are zener-regulated for better stability. Their outputs are in series, and are selected by switching power back and forth between them. There's also an AM/CW mode switch. With the tunable AM mode, WWV can be tuned in at 10 MHz. It tunes the entire 30 meter band, which contains many shortwave broadcasts.

The receiver's preamplifier and two IF amplifier stages make it quite sensitive, and a manual gain control is incorporated as a basic necessity. The simple but effective 455 kHz variable BFO provides a means of CW tone adjustment from the receiver's front panel. The BFO's power input is zener regulated for stability, but some power-up drift is noticeable and minor adjustments are occasionally needed. The two stage 800 Hz audio active CW filter can be switched in when the band gets congested. My junk box had an abundance of small low capacitance panel mounted variable capacitors in it, so I designed the printed circuit board with them in mind. These variable capacitors may be expensive and hard to find, so I devised a simple circuit using varactor diodes for frequency control of the tunable local oscillator and BFO.

The LM-386 audio output IC provides plenty of audio output to a set of headphones, or a small speaker. I measured a receiver current drain of approximately 40 milliamps when using a 12-volt bench supply and receiving a moderate signal. (This is a very simple bare-bones receiver!) While listening to a received signal, or the transmitter's sidetone, the listener hears a mirror image as the BFO is adjusted through each side of zero beat. He must make a quick check before replying to a CQer by rotating the BFO knob slightly to see if he is actually on another listener's operating frequency!

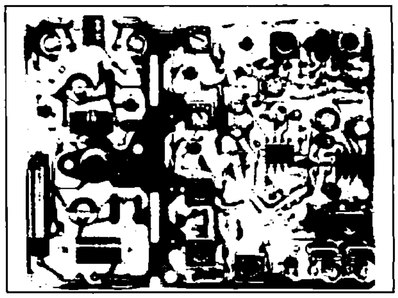


Photo C. Parts placement.

The transmitter consists of a two frequency crystal controlled oscillator, a keying transistor, and a power output final. A steady, chirp-free, CW tone is achieved by keying the oscillator stage and leaving power applied to the output final during transmit. R3 and C4 in the keying circuit provide good rise and decay times for proper CW signal shaping. The keying transistor stage simplifies the interfacing of an electronic keyer or a computer.

The transmitter printed circuit board layout has pads to accept a Radio Shack 275-241 relay used for the transmitter's crystal frequency switching. One set of contacts of a DPDT switch changes crystal frequencies in the receiver's crystal local oscillator, while

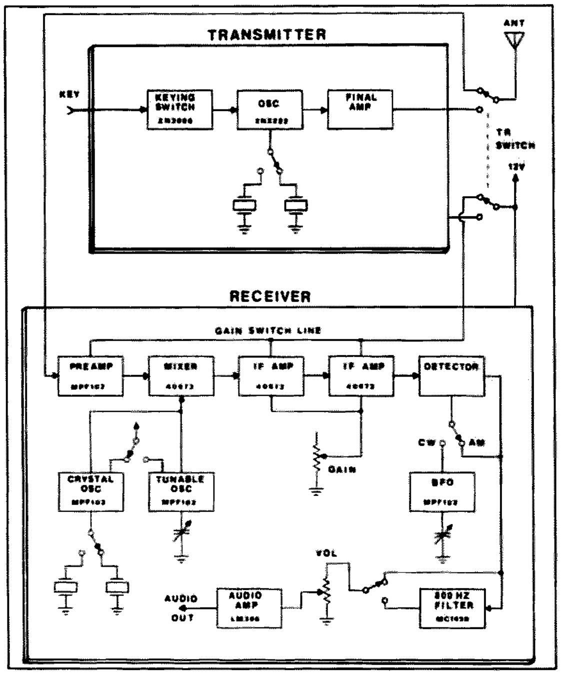


Figure 1. Block diagram of the Pee Wee 30 transceiver. The transmitter and receiver sections are on separate boards.

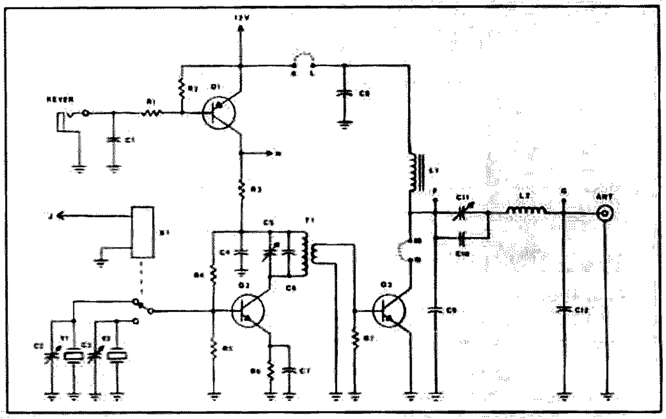


Figure 4. Schematic for the transmitter section of the Pee Wee 30.

the other set of contacts switches the relay on the transmitter board. Without this relay, separate switches are needed in the receiver and transmitter for the crystal switching. My choice of output final transistor was simply a matter of which junk box transistor worked best! With a 2N3053 transistor in the output final stage, and a bench power supply set to 12.5 volts, an input power of 2 watts was measured.

I found that a 2SC777, which is used in CB transmitters, gives good output power, and needs no heat-sinking due to its large surface area. I calculated a healthy 3 watts of input power to the transmitter final with the 2SC777 installed. This transistor, however, may not be easy to find.

CONSTRUCTION NOTES

Figures Overview

Figure 1 shows a functional block diagram of the transmitter and receiver as separate circuits, and the simple connection between them to form a transceiver. The receiver schematic is divided into two separate drawings, Figures 2 and 3. Points A and B are direct connections between the two receiver schematics.

Figure 4 is the transmitter's schematic diagram. When built as a transceiver, a DPDT switch takes care of the transmit/receive switching. I put this switch on the rear of rig up high where it's easy to reach. One half of the switch is used for switching the antenna to the receiver and transmitter. The other half switches 12 volts to the receiver's gain control line during receive, and supplies 12 volts to the transmitter during transmit.

Receiver

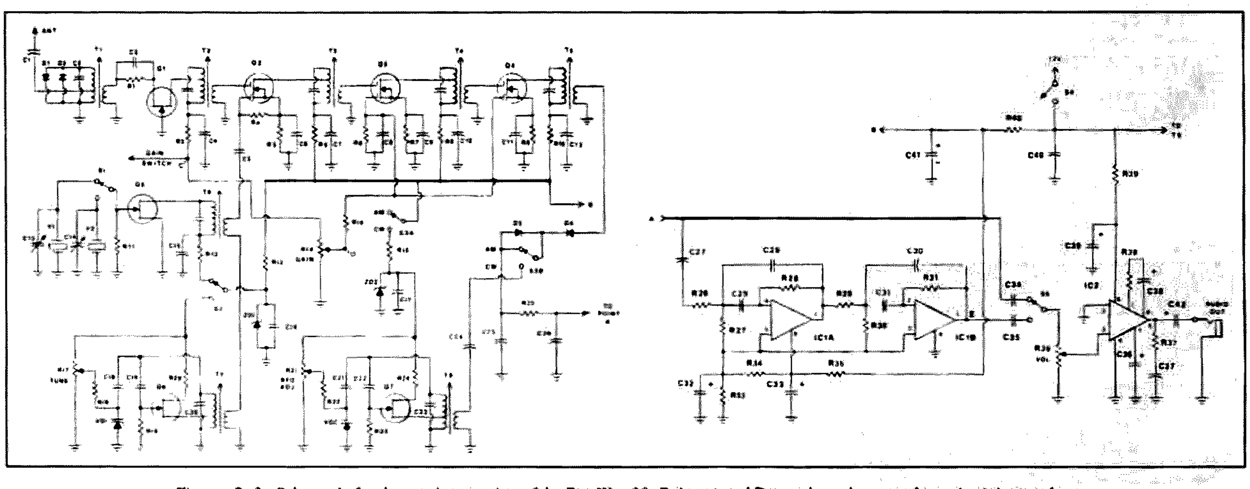
You must remove the internal capacitor from transformer T1. Disassemble the transformer and cut the leads carefully with a sharp knife, and pull the capacitor out through the bottom. Take care to not cut the leads of the transformer windings! Capacitor C2 on the circuit board will now determine the tuning range of this transformer.

You must remove a lead from transformers T4 and T5 before installing them on the PC board, because there are no holes provided for them. Transformers T6 and T7 have a mounting tab on their shield cans that also must be removed. Figure 6 illustrates which leads and tabs to remove. Again, careful around the transformer winding leads!

Capacitors C34 and C35 are not mounted on the PC board. They must be connected between the PC board and switch S5. My first rig had only one capacitor, which was placed between S5 and the volume control R36. That arrangement produced a pop in the earphones when the filter was switched in and out.

If you choose to use varactor tuning instead of variable capacitors in the receiver's tunable local oscillator and BFO circuits, then you must make some component connections off of the PC board. This is necessary

[Figure 5 (A), the PC board trace, is continued on page 85.



Figures 2, 3. Schematic for the receiver section of the Pee Wee 30. Points A and B are where the two schematics join together.

30 Meter Receiver Parts List

Capacitors	C1	100 pF Ceramic Disc		R18,R22	47k *
	C2	22 pF Ceramic Disc		R25	1.5k
	C3,C4,C15	.022 µF Ceramic Disc		R26,R29	680k
	C5	39 pF Ceramic Disc		R27,R30,R33,R34	24k
	C6-C12	.047 µF Ceramic Disc		R28,R31	1.8M
	C13,C14	4-34 pF trimmer 7mm		R32	Skipped
	C16,C17,C40	.1 µF Ceramic Disc		R36	10k pot with switch *
	C18,C21	47 pF Silver Mica *		R37	10
	C19	120 pF Silver Mica		R38	1.2k
	C20	33 pF Silver Mica		R39	150
	C22	820 pF Silver Mica		R40	68
	C23	82 pF Silver Mica	All resistors are ¼ Watt 5%		k = 1,000Ω M = 1,000,000Ω
	C24	.01 µF Ceramic Disc	**Transformers**	T1,2	10.7 MHz Green
	C25	.0047 pF Ceramic Disc		T3	455 kHz Yellow
	C26,C27	.01 µF 50 VDC Monolythic		T4	455 kHz White
	C28-C31	1000 pF 50 VDC Polystyrene Radial		T5	455 kHz Black
	C32,C33,C36,C38	10 µF 16 VDC Electrolytic Radial		T6	10.7 MHz Blue
	C34,C35	.22 µF 50 VDC Monolythic *		T7	10.7 MHz Orange
	C37	.047 pF 50 VDC Monolythic		T8	455 kHz Black
	C39,C42	220 pF 16 VDC Electrolytic Radial	Crystals	Y1,Y2 = (TX freq. – 455 kHz) HC/25U 30 pF 0.0025 tol.	
	C41	100 µF 16 VDC Electrolytic Radial	Diodes	D1,D2	1N914
Resistors	R1	270		D3,D4	1N34
	R2,R5,R8,R10,			VD1,VD2	ECG612 *
	R12,R20,R24	120		ZD1,ZD2	1N754
	R3,R35	560	Transistors	Q1,Q5-Q7	MPF102
	R4,R16,R19,R23	100k		Q2-Q4	40673
	R6	33k	ICs	IC1	LM1458
	R7,R9	390		IC2	LM386
	R11	47k	Switches	S1-S3,S5	miniature DPDT slide switch *
	R13,R15	220		S4	part of volume control R36 *
	R14,R17,R21	10k pot, linear taper *	*Parts not mounted on the PC board.		

Table 1.

because the PC board was designed to use variable capacitors for tuning, and varactor tuning was an afterthought.

The point where VD1, R18, and C18 connect in the tunable local oscillator circuit, and the point where VD2, R22, and C21 connect in the BFO circuit must be made above the board. Solder the anode ends of the varactor diodes VD1 and VD2 in the holes at ground potential of the transformer windings, and stand them up. Solder the 47 pF mica capacitors C18 and C21 in the holes at the ungrounded side of the transformer windings, and stand them up. The other end of the 47 pF mica capacitors and varactor diode cathodes, and one end of the 47 kΩ resistors R18 and R22 are connected above the board. These components should be secured to the side of the transformers with some glue to keep the oscillators from shifting due to mechanical shock or vibration.

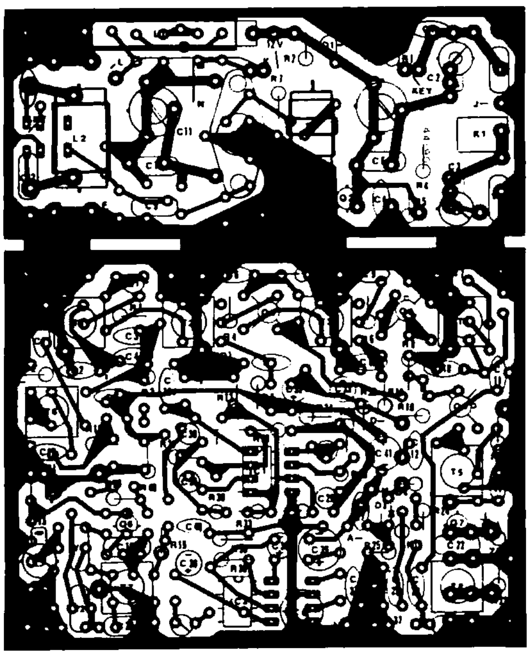


Figure 5 (B). Parts placement of the 30 meter transceiver.

The voltage for the BFO's tuning potentiometer R21 is obtained by a connection at the cathode of zener diode ZD2, either above or below the PC board, whichever you prefer. The voltage for the tunable local oscillator's tuning potentiomer R17 is obtained by a connection at the switched side of R20 in the same manner.

If you have variable capacitors and wish to use them for tuning, then omit the 47 pF capacitors C18 and C21, the varactor tuning diodes VD1 and VD2, the 10k potentiometers R17 and R21, and the 47kΩ resistors R18 and R22. Place the variable capacitor in parallel with C20 in the tunable local oscillator

Receiver Parts Acquisition

C13,C14	Mouser 24AA113
C18,C21	Jameco DM15/470
C19	Jameco DM15/121
C20	Jameco DM15/330
C22	Jameco DM15/821
C23	Jameco DM15/820
C26,C27	Jameco MD.01/50
C28,C31	Mouser 23PW210
C32,C33,C36,C38	Digikey P6023
C34,C35	Jameco MD.22/50
C37	Jameco MD.047/50
C39,C42	Digikey P6228
C41	Digikey P6227
R14,R17,R21	Mouser 31CN401
R36	Mouser 31CQ401
T1,T2	Mouser 42IF126
T3	Mouser 42IF101
T4	Mouser 42IF102
T5	Mouser 42IF103
T6	Mouser 42IF129
T7	Mouser 42IF124
T8	Mouser 42IF106
Y1,Y2	Jan Crystals
	Crystal Sockets
	Jan Crystals CE25
D1,D2	Jameco
D3,D4	Mouser
ZD1,ZD2	Jameco
Q1,Q5-Q7	Jameco
Q2-Q4	Jameco
IC1,IC2	Jameco
S1-S3,S5	Radio Shack

Table 2.

DIGI-KEY PO Box 677 Thief River Falls MN 56701 (800) 344-4539	Mouser Electronics 2401 Hwy 287 North Mansfield TX 76063 (817) 483-4422
Jameco Electronics 1355 E. Shoreway Road Belmont CA 94002 (415) 592-8097	Jan Crystals 2400 Crystal Dr. PO Box 06017 Ft. Myers FL 33906-6017 (800) 237-3063

Table 3.

circuit, and C23 in the BFO circuit. Very little capacitance is needed. I used variable capacitors with an approximate tuning range of 5–10 pF and they were very adequate.

Transmitter

There are two wire jumpers on the transmitter board that have to be installed. As shown on the transmitter's schematic, Figure 4, there's a jumper from points M and N in the collector circuit of the transmitter final, and a jumper from points K and L which connects the 12 volt power input between the keying and final stages. Don't forget them!

When built as a transceiver, Point J on the transmitter schematic is switched 12 volts, brought over from the unused section of the receiver's crystal selector switch S1. I placed a 0.1 µF capacitor across these switch contacts in my second rig to kill the annoying pop in the earphones during frequency switching.

I used HC/25U, 30 pF, 0.0025 tolerance crystals in the receiver and transmitter, ordered from Jan Crystals. This type of crystal works well in the receiver. When this type of crystal is used in the transmitter however, they will oscillate approximately 2 kHz lower than their actual frequency. After discovering this problem during the tune up of my first unit I have since been ordering crystals cut for 2 kHz above the desired transmitter frequency.

Transmitter transformer and coil construction is fairly simple. For coil form material, I purchased some small PVC plastic tubing at the local hobby shop. I then stripped wire from an old unused coil in my junk box. For transformer T1, use a coil form with an ¼″ outside diameter. Drill two small holes

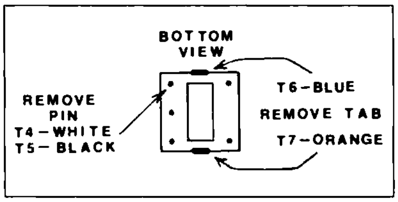


Figure 6. In the receiver, you must remove one pin from both T4 and T5, and one tab from T6 and T7.

30 Meter Transmitter Parts List

Capacitors	C1	.022 µF Ceramic Disc
	C2,C3	4–34 pF trimmer 7MM
	C4	.22 µF 50 VDC Monolythic
	C5,C11	16–100 pF trimmer 10MM
	C6,C10	47 pF Silver Mica
	C7,C9	220 pF Silver Mica
	C8	.1 µF Ceramic Disc
	C12	330 pF Silver Mica
Resistors	R1	2.7k
	R2	10k
	R3	47
	R4	27k
	R5	10k
	R6	470
	R7	47
Transistors	Q1	2N3906
	Q2	2N2222
	Q3	2N3053 or 2SC777
Crystals	Y1,Y2 (TX freq. @ 2 kHz) HC/25U 30 pF .0025 tol. **	
Relays	K1	SPDT 12 VDC Coil PC mount
Coils and Transformers	L1	100 µH RF choke
	L2	27 turns of #24 ga. enameled wire closely wound on a 5.16″ coil form.
	T1	23 turns of #26 ga. enameled wire closely wound on a ¼″ coil form, then heat shrink over the coil.

The secondary winding is four turns of small insulated hook up wire which is wound over the heat shrink tubing
**See construction notes on transmitter crystals.
All resistors are ¼ watt 5% tolerance

Table 4.

through the coil form 13.32″ apart with a very small drill bit, like the one that drilled the PC board holes. Thread a couple of inches of #26 gauge enameled wire through one hole, and then tightly wind 23 turns to the other hole. Cut the wire, leaving a couple of inches to thread through the remaining hole. Place some heat shrink tubing over the coil to secure it. For T1's secondary winding, wrap four turns of some small gauge insulated hookup wire tightly around the primary coil before installing it on the PC board. L2 is made the same way as the primary of T1. Use a coil form with a 5.16″ outside diameter. Drill the small holes ⅝″ apart, and wind it with 27 turns of #24 gauge enameled wire.

Photo B shows the inside of my first rig. All of the front panel controls were mounted as close to their associated circuitry as possible. The PC board, measuring 3.8″ x 4.7″, can easily fit into one of the many cabinets available, like Radio Shack's 270-252A, which is 4 x 2⅜ x 5⅞. I made my own cabinet, but used the top portion of the Radio Shack cabinet because it's made of steel, and it has a nice paint job. My chassis also opens from the bottom for easy servicing. Ten AA NiCds, which sit in the chassis bottom, power the rig.

Options

To omit one of the local oscillators from the receiver circuit, place a jumper on the circuit board where the secondary of the unused oscillator transformer normally is. This is necessary to complete the circuit path for the mixer's local oscillator injection input.

Those who just want AM for monitoring WWV can omit the BFO circuitry and place a jumper where diode D3 is normally installed.

The relay on the transmitter PC board draws an extra 37.5 milliamps of current drain when energized, shortening battery operation time. If a switch is substituted for the relay in the transmitter for frequency switching, then it should be placed as close to the crystals as possible to keep the lead lengths short.

20/40 Meter Operation

The Pee Wee 30 is easily modifiable to 20 and 40 meters. The builder need only change the number of turns in the coils, the values of fixed capacitors C6 and C10, which are in parallel with the trimmer capacitors, and, of course, the crystal frequency. Some experimentation is necessary. I provided extra holes on the transmitter board to accomodate a smaller RF choke in the final circuit, and extra holes for a different size output coil. You can use any transformers with the proper lead spacing in the receiver's front end and oscillator circuits.

Those wishing to wind their own coils for another band should look to Amidon Associates' L43 series coil forms. They have the proper lead spacing. I have stripped the 14 turns of wire from the tuned side of a 10.7 MHz transformer used in the receiver preamp and replaced it with 20 turns of #32 gauge wire. The transformer's new tuning range was from 6–8 MHz. ■

(Part II: Alignment and Testing)

Transmitter Parts Acquisition

C2,C3	Mouser 24AA113
C4	Jameco MD.22/50
C5,C11	Mouser 24AA034
C6,C10	Jameco DM15/470
C7,C9	Jameco DM15/221
C12	Jameco DM15/331
Q1,Q2	Jameco
Y1,Y2	Jan Crystals
	Crystal Sockets
	Jan Crystals CE25
K1	Radio Shack 275-241
L1	Radio Shack 273-102
	Heat sink for 2N3053
	Mouser 33HS261

Table 5.

73 Review by Bryan Hastings, NS1B (ex-KA1HY)

Nye Viking RFM-003 RF Power Monitor

Wm. M. Nye Co., Inc.
1614 130th Ave. NE
Bellevue WA 98005
Price Class: $297, with coupler and charger

Nye calls their new product a "power monitor" because of the variety of ways it looks at RF en route from the rig to the antenna (or back). This simple unit—the RFM-003 sports only five controls—is one of the more versatile RF monitoring devices on the market. In addition to SWR, forward, and reverse power measurements, it measures average power, holds peak power measurements for a user-selectable period, and automatically switches power ranges. Its highlight feature is the Amplifier Lock-Out (ALO) circuit, which unkeys a linear amp when it senses too much back RF.

Physical Features

The Power Monitor package comes in two parts—the dual-meter control box and the RF coupler. The coupler goes in-line between the transceiver (or linear) and the antenna (or tuner). (See photo). This 3" x 2-½" x 2" gray metal box has two opposing SO-238 connectors and a supple four-conductor cable about six feet long that connects to a plug on the rear panel of the control box. This coupler is directional, and the RF input and output connections are clearly marked. There are no stiff coax cable connections to hamper meter box positioning around the operating console!

The dark gray control box measures 8" x 4" x 3." Attached to it is a wide mounting swivel bracket, rotatable 360° around the width of the unit. This allows the op to mount the meter either from above, as in the case of the lower part of a car's console or lower dash, or from below, as under a ham shack table. It can also be removed, allowing the unit to stand on its own (rubber) feet.

The Front Panel

The SWR upper front panel has two meters side by side labelled SWR and RF WATTS. On the lower front panel, from left to right, is a Hold-Time variable control, six LEDs, and a three-position switch for PEAK POWER, PEAK POWER AND HOLD, and AVERAGE POWER. The Hold-Time control works when the switch is set for PEAK AND HOLD—it "freezes" the RF WATTS needle at its maximum deflection for up to 20 seconds, for easy reading.

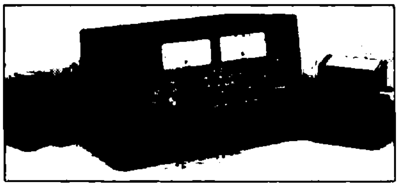


Photo A. The front panel of the RFM-003 and RF coupler.

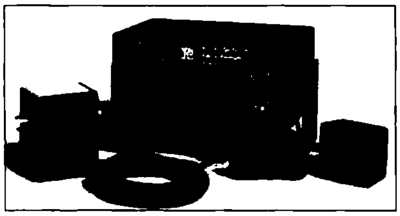


Photo B. Back panel of the RFM-003 and RF coupler.

The LEDs are arranged in three pairs. The first pair gives the status of the ALO circuit (discussed later). The middle pair deals with peak power measurement—one of them lights when the Monitor samples the RF, and the other lights when the RF WATTS needle holds at a maximum deflection.

The right-most LEDs are low and high RF scale indicators. On the RFM-003, the RF WATTS scale shows 0–300 W. This, however, *automatically* reverts to a times-ten scale (0–3000 W) when the unit senses RF power beyond 300 Watts, and the red LED lights to indicate that state.

A note on the brother model to the RFM-003, the RFM-005. The only difference between the two models is the power scales—the RF WATTS dual meters shows up to 500 and 5000 Watts, respectively, on the RFM-005. A ham has to obtain the specific RF coupler for this.

Back Panel

The two two-position slide switches allow for measuring either forward or reverse power and setting the kind of ALO trip the user wants (again, more on this later). Below them are the two RCA phono jacks to put the ALO circuit in line.

Straying over to the right side of the panel, the user finds two plugs—for 12 VDC external power source and Coupler attachment. Finally, next to the Coupler input is ALO SENSE, a recessed pot.

Powering the Monitor

The essential functions of the Monitor—needle deflection, LED lighting, and circuit powering itself—can run off a pack of four NiCds secured to the inside back panel of the meter box. The coupler shunts RF energy to the meter box to keep these batteries fully charged. The only function dependent on 12 VDC external power is the meter back-lighting. External power can also charge the NiCds.

Be Kind To Your Finals

Perhaps the most interesting feature on the RFM-003 is the ALO (Amplifier Lock-out) circuit. The user can set a limit—either SWR or reverse power—by first setting the rear panel switch to either SWR or REV and then adjusting the ALO Sense with a tweaker. The beauty of REV-mode ALO is that, once one knows the maximum tolerable reflected power to the

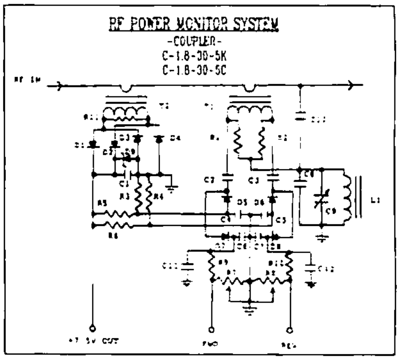


Figure 1. Schematic of the RFM-003 meter box circuit. R10 is located in the upper left section of the diagram.

Specifications

Accuracy	±5% of full scale
SWR Threshold	5W for the 5000 W RF coupler
Sample Time	For Peak and Hold, 1ms typical, 3ms maximum.
Hold-Time	.5 to 20 seconds typical
ALO SWR Adjustment Range	Approx. 1.6:1–7:1, factory set at 2:1
ALO Rev. Adjustment Range	For (K) couplers, 40–400 watts, factory setting 100 watts. For (C) couplers, 4–40 watts, factory setting 10 watts.
ALO Relay Contact Ratings	5 amps 120 VAC/28 VDC.
Power Consumption	Maximum operating450 mW Typical Operating 64 mW
Size	H 5" x W 8½ x D 5¾ max. values with swivel bracket fully extended.
Weight	4 lbs. Shipping 5 lbs.

tubes, it's not necessary to go through algebraic gymnastics (see sidebar) to figure the maximum forward power for every new SWR. Just set the ALO sense at that reverse power level and leave it!

When the chosen value exceeds the limit, the ALO relay opens whatever circuit it's in line with—usually the keying relay line between driver and amp.

Opening the relay line, however, sometimes doesn't do the trick. Many QSK amps running in QSK mode don't pay any attention to the driver-amp relay line. They keep chugging along only until they stop sensing RF at their input. For this case, Nye suggests putting the ALO circuit in series with the PTT line.

Specs. vs. Observations

I was able to compare a few of the specifications listed in the manual (see sidebar). The driver was the IC-761, which outputs a minimum of five watts—still enough to activate the SWR circuit. Hold-Time did indeed, have a maximum of 20 seconds.

For the ALO reverse adjustment range, however, the minimum setting was 50–55 Watts. This is still in line, since most linear amp finals can handle this minimum level of back power continuously. Those who find the range too high, however, can easily rectify it by replacing a resistor on the meter box PC board with one of a lower value. Contact Nye for more details on this modification.

Performance

I have been using the Monitor at my home station for the past few months with no troubles. It ran the gauntlet during the *73 Magazine* St. Pierre and Miquelon (FP/) DXpedition on Memorial Day weekend. Wayne W2NSD, Larry NA5E, and myself operated three 100-watt stations from a hotel room, feeding three antennas on the same hotel roof. There I found that when the other ops transmitted, the ALO sense LEDs and the SWR meter flickered and deflected madly. This occurred when we experienced only low-level (S-2) mutual QRM while operating on different bands on our rigs (one IC-761 and two IC-735s).

When we returned from St. Pierre, I called the Nye plant and spoke with Chris Mason, one of the developers of the power meter, about this problem. He explained that this was a result of the type of detection circuit in the RF coupler, and that roughly 1% of those who bought the monitor lived close enough to broadcast stations to experience the same trouble. The meter is simply so sensitive that it is triggered by sufficiently strong incoming RF! The meter, of course, doesn't see any difference between this and reflected power.

Chris suggests that those who live near FM broadcast stations install a low-pass filter in their antenna system. Offending AM broadcasts, however, require replacing R11, a 1kΩ (see RF Coupler schematic, Figure 1) to a lower value, such as 220Ω or even 100Ω. This does reduce power meter accuracy at low power, though not dramatically—it is within 5% at 20 watts out.

THE VIRTUE OF REV-MODE ALO

The ability to set a reverse power limit is an excellent idea. This allows the op to safely operate under varying SWR conditions. The next few paragraphs explain why.

Many linear amp manuals give reverse power tolerances only in terms of SWR. Bear in mind, however, that SWR is only a *ratio* of forward power to reverse power. For a given SWR, the lower the forward power, the lower the reverse power. The amp finals, however, don't care a whit about forward power in itself (except when they're forced to generate too much of it). They care only about the value of the reverse power, regardless of the SWR/forward power combination from which it results. In other words, higher SWRs than those stated in the manual are OK, provided the amp is run at sufficiently low forward power.

So what explains the seeming inconclusiveness of the SWR tolerance figure? The authors of the linear amp manual evidently assume the amp user will spend most of his time running the *full legal limit*, and they figure the SWR tolerance based on that. A ham doesn't have to run his amp at full bore, however, and is even encouraged not to do this unnecessarily. Lower-than-maximum forward power levels allow higher-than-manual spec. SWRs.

Let's look, for example, at the linear used for the accompanying review, the Barker & Williamson PT-2500A. The manual states that the operator must not run it over 2:1 SWR. (Earlier 2500 manuals state 1.5:1 SWR.) Assuming this was figured at 1000 W of forward power (which a call to Elmer W3FVT at Barker & Williamson confirmed), I calculated the maximum allowable reverse power in the following five steps:

1) $$\text{SWR} = \frac{1+x}{1-x}, \qquad \text{where } x = \frac{\text{reflected power}}{\text{forward power}}$$

Plug in the above SWR value and solve for x through cross multiplications:

2) $$2 = \frac{1+x}{1-x}, 2 - 2x = 1 + x, 1 = 3x, x = .33$$

For 2:1 SWR, then, the square root of forward over reflected power will always equal .33. Squaring both sides gives:

3) $$.33^2 = \frac{(\text{refl. pwr.})^2}{(\text{for. pwr.})^2}, \qquad .11 = \frac{\text{refl. pwr.}}{\text{for. pwr.}},$$

4) $$\text{forward power } (.11) = \text{reverse power}$$

Formula 4) figures the reverse power for a given forward power when the SWR is 2. Plugging in the maximum forward power allowed, 1000 Watts, gives:

5) $$(1000\text{ W})(.11) = 110\text{ Watts}$$

This is the maximum safe continuous returned power the B & W PT-2500A finals can accept.

Knowing this figure, it's possible to calculate the maximum allowable SWR for any forward power level, and vice versa. Say a ham can't tune his antenna lower than 2.5:1 SWR at the frequency he wants to use. Figure x for SWR = 2.5, as done in 2)

6) $$2.5 = \frac{1+x}{1-x}, \; 2.5 - 2.5x = 1 + x, \; 1.5 = 3.5x, \; x = .43$$

By the methods used in 3) and 4):

7) $$\text{forward power } (.18) = \text{reverse power},$$

8) $$\text{forward power} = \frac{\text{reverse power}}{.18}$$

Plugging in the maximum allowable reflected power of 110 Watts gives a maximum forward power of:

9) $$\text{forward power} = \frac{110}{.18} = 611\text{ Watts}$$

Considerably more power than most barefoot rigs! This output is certainly worth keeping the amp in line.

The beauty of being able to set a reverse RF limit to unkey the amplifier is not having to refigure the maximum forward power for each new SWR. Even if the linear amp manual gives the tolerance only in terms of SWR, just go through steps 1)–5) once, to determine the maximum back power the tubes can handle. Then set the calculated ALO limit and crank the drive to the amp until that limit is reached. Trim back the drive slightly, and it's set!

Conclusions

The RFM-003 commends itself in all areas. The only concern potential buyers of this unit should have is their RF environment. If they live particularly close to AM broadcast stations, they have to be prepared to do the above modification and lose some meter accuracy. The unmodified unit is so accurate, however, that users shouldn't despair over not being able to get their match completely flat. Even though their previous meter may have shown 1:1 on the same system, the RFM is just showing more the reality of the situation. ■

PATENTS ARE UNIQUE

Protecting Your Brainchild

by W. Max Adams W5PFG

Briefly speaking, in Federal (English?) language, "The United States of America to all whom these presents shall come: whereas, there has been presented to the Commissioner of Patents a petition praying for the grant of Letters Patent for an alleged new and useful invention..."

Such are the first words on the red-seal, blue-ribbon, riveted front cover page of my patents, numbers 3657603 and 3814950. This article is not a legal advisory on how to obtain patents, rather it is intended to help you get on the right track when your brainchild is *unique* and you want to obtain a US patent.

Later, the first page continues:
"WHEREAS, upon due examination made, the said claimant(s) is (are) adjudged to be entitled to a patent under the law."

Patents are unique in many ways. A US patent, by law, dictates that it contains a "new and useful" invention belonging to "said claimant(s)." This means that your patent claims were successfully defended and are protected *by law* from others who may later try to claim, use or sell your invention. The Patent Office may also issue patents to anyone making improvements to previously patented inventions, irrespective of the holder of the original patent.

Patents are granted for a term of 17 years (14 years for design patents) and may be extended only by a special act of Congress. After a patent expires, "the patentee loses rights to the invention."

The patenting process is long, tedious, and to some degree expensive. Subsequently, many unique ideas are simply passed along and never recognized under the law.

Creative Minds, Capable Hands

Patents are the result of a creative mind linked to capable hands. One facet of amateur radio is the solder-burning, mechanically-constructive, home-brew ideas of creative individuals. Many are asked, "Why don't you get it patented?" Often they reply, "I think I will!"

Silently, you ask yourself, "How do I get a patent?" You answer, "I don't know, better see me a lawyer fella, maybe. Just maybe he'll shed some light on the procedure." The US Patent and Trademark Office maintains a register of attorneys and agents who have met the legal, scientific, and technical requirements, and who have agreed to uphold a standard of professional conduct.

I was lucky. An acquaintance at work had just received his patent.

"Why not give my patent attorney in Washington a call? He will be glad to help you. That's his business. He is just across the street from the patent office and can save you some leg work."

Dealing With The Law

Your patent attorney will only tell you your idea "has possibilities!" He will initiate a patent search, with advance payment of his fee, and advise you of his findings, then describe the next steps, and the advance payment for performing the next step.

Recently, I followed my previous footsteps, and called the same number I used in 1971. Naturally, I was not remembered. However, when I referenced my two patent numbers, my lawyer fella found something in his files and referred me to Mr. Oscar Mastin (703-557-3341) at the US Department of Commerce, US Patent and Trademark Office, Office of Public Information, Washington DC 20231. (Direct your questions to: 703-557-4636). Mr. Mastin was very polite. Within 5 days I received a free copy of *Basic Facts About Patents*, which details what patents are, who may obtain them, and many more useful details to help inventors. The booklet answers most of the fundamental questions about patents. What is a patent? "A grant of a property right by the Government to the inventor..."

What types of patents are there? "The patent laws provides for the granting of patents in three major categories; Utility Patents, Design Patents and Plant Patents (...any new and distinct variety of plant, including cultivated...)"

Who may obtain a patent? "Patents are granted only to the true inventor."

When can you obtain a patent? "A valid patent may not be obtained if the invention was in public use or on sale in this country for more than one year prior to the filing of your patent application. Your own use and sale of the invention for more than a year before your application is filed will bar your right to a patent just as effectively as though this use and sale had been done by someone else."

What about ownership and sale of patent rights? "The inventor may sell all or part of his interest in the patent application or patent to anyone by a properly worded assignment."

Is your invention protected in foreign countries? "The United States patent protects your invention only in this country."

How can you obtain copies of previous patents? "Printed copies of any patent, identified by its patent number, may be purchased from the Patent and Trademark Office at a cost of $1.50 each. NOTE: Prices subject to change."

What does "patent pending" mean? "The terms 'patent pending' and 'patent applied for' are used by a manufacturer or seller of an article to inform the public that an application for patent on that article is on file. The law imposes a fine on those who use these terms falsely."

Will the Patent Office offer legal help? "The Patent and Trademark Office cannot assist in preparation of application papers, and strongly advises prospective applicants to engage the services of a patent attorney...The Office will answer an applicant's inquiries about the status of any application, but if you have an attorney or agent, correspondence should be forwarded through them."

What about promoting and marketing your inventions? "The Office cannot assist in development and marketing of an invention...Office has no control over...patent promotion organizations. It is advisable to check..."

Basic Facts About Patents also includes information about patent application, disclosure document program, patent searches, and patent fees. Incidentally, the basic filing fee is $340 and later, the issue fee is $560. "These amounts are reduced by 50% when the applicant is a small entity..."

Alternatives

An "electronic" patent, obtained by a private individual (without any assignment), is a very difficult but ego-satisfying achievement. If you have a unique idea, you may want to encapsulate it in plastic, flood the market, then get to work on another brainchild. Next best, file for a patent, and when it becomes eligible for "Patent Pending," keep it that way (if you can afford to do so). Or obtain a copy of a previously issued patent for $1.50 that becomes available to the world, as I did. An office full of corporate lawyers and engineers can then blow it full of holes, improve it, simplify it, and leave you with a nice document suitable for framing!

In '72, about one year and $2000 later (including patent office fees), I finished reading the cover page.
"In testimony whereof, I have hereunto set my hand and caused the seal of the patent office to be affixed at the City of Washington this eighteenth day of April, in the year of our Lord one thousand nine hundred and seventy-two, and the Independence of the United States of America the one hundred and ninety-sixth."

At least I can point to the two frames on the wall and proudly say, "Yes sir, at least mine was the FIRST!"

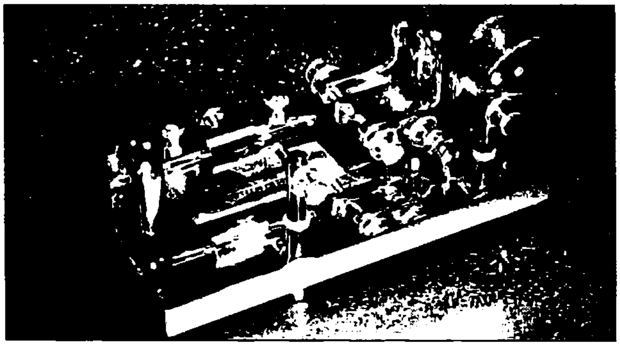
Do not be discouraged by all the legal terms, paperwork, and patience required. If you have a special idea, burn some solder, and go for it!

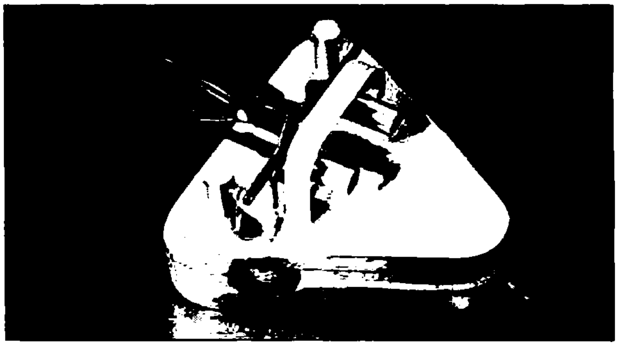
73 Review *by Larry Ledlow, Jr. NA5E*

Beauty and the Best

Something old, something new from Vibroplex

Vibroplex
98 Elm Street
Portland, ME 04101
Price Class: Original Deluxe: $85
Brass Racer EK-1: $115





What's this? A few months ago I wrote an editorial espousing a no-code ham license. So what am I doing reviewing keyers? Truth is, I *like* CW. I've always had a sort of affair with this much-maligned mode. And these two offerings from Vibroplex have made my affair so much the sweeter. A CW craftsman with proper and elegant tools from Vibroplex can make beautiful music over the airwaves.

Vibroplex has offered quality "tools" for code craftsmen for almost 100 years. Anyone who has tried to send more than 15 words per minute with a straight key knows the limitations of their fist. Before Curtis brought modern, electronic iambic keying to telegraphers, the Vibroplex "bug" was a standard to which all other high-speed sending keys were compared.

Comparing the Vibroplex Original key and their Brass Racer is a bit like comparing a harpsichord and a modern music synthesizer. They both render sweet tones in the right hands, but the skills needed to manipulate them are different. They probably appeal to different types of people. One thing is certain, though: they both represent some of the finest code keys available today.

The marvelously mechanical Original bug first attracted my attention as an object of historical interest. I carefully unpacked my new bug (serial number 54815) only to be overwhelmed by its sheer beauty and intricate mechanical design. The deluxe model's chrome plating and bright red paddle make it a real standout in today's charcoal gray and black ham shack. After some study, I began to appreciate its mechanical operation: springs, levers, and a vibrating mass. Boy, could I have had some fun with a bug in one of my college physics classes!

Bug operation requires somewhat different skills than those developed with most electronic keyers. Pressing the paddle to the right causes the pendulum to vibrate and to touch the dot contact nearest the adjustable mass. After the required number of dits are completed, the operator releases the paddle, and the pendulum oscillations are damped out. Dit speed increases with the mass moved inwards. Easy, huh? The tricky part comes in making dashes.

Users of iambic keyers are used to having the machine make proper length dashes, or dahs. Not so here. The sender must manually close the dash contact for the proper duration. Many programmable electronic keyers offer this semi-automatic operation mode. *Minimum* speed with a bug is about 15 words per minute.

Remember Elmer's advice to use wrist and fingers, not arm motions to send clean CW? Forget all that with a bug. Bug operation requires free arm movement for proper operation. Do not grasp the paddle, either. The bug should be operated with thumb and two fingertips spaced wider than the paddle and free, easy arm movements back and forth. Now that's different.

No electronics and just a few electrical contacts to keep clean make the Original bug suitable for any environment. Further, a bug in the right hands not only looks good; it *sounds* great.

As good as the Original bug is, many CW operators will prefer the Vibroplex Brass Racer. The Racer is an attractive key with a triangular, heavy brushed brass foundation mounted atop a walnut base. Model EK-1 includes a Curtis 8044 IC-based electronic keyer built into its base. The Racer's gold tone and black paddles would look good in any shack.

The EK-1 Racer can be used with any positively or negatively keyed transceiver. (Most tube-type rigs use positive keying.) The data sheet that comes with the keyer gives very clear instructions on proper wiring. Aside from a ¼-inch phono plug, the EK-1 comes with a 7.5V battery (Duracell T-175 equivalent) to power the keyer for a year or more and a hex key to adjust paddle tension and spacing.

The Racer had a number of surprises, not the least of which is the way paddle tension is adjusted. Two brass holders located on the back side of the paddle mount contain tiny magnets, which attract steel crossbars on the paddles. By increasing or decreasing the distance between the magnets and the crossbars, tension decreases or increases accordingly. I like this feature a lot. It sure beats complicated spring and screw adjustments found elsewhere.

After reading the keyer instructions, I removed the two retaining screws on the base bottom to expose the EK-1's keyer circuit. The PC board is well laid out and provides easy access to all components, including a socketed IC, should the need arise to repair the keyer. Surprisingly, the battery holder does not have any clear polarity markings, and the instructions stress the importance of observing proper battery polarity. Gee, I wonder how many keyers have smoked because users didn't read the instructions or didn't have them available for reference. Even though a + could easily be added with a marking pen, I don't think buyers should have to worry about things like that, especially considering the EK-1's price.

The last surprise was the speed (5–50 wpm) adjustment pot, which is slightly recessed on the right side of the base. Considering the fine overall finish of the Racer, to find a bare 500kΩ plastic potentiometer here is a disappointment. The pot on my Racer is very stiff and difficult to adjust. I would certainly expect a slightly larger knob with smoother action on a keyer in this class.

Nonetheless, Vibroplex is still the first name in code. Anyone half serious about CW should have at least one of these beauties in their arsenal. They are, after all, simply the best!

73 Review *by Larry R. Antonuk WB9RRT*

CT-90 Portable Frequency Counter
Review Ramsey Electronics, Inc.
2575 Baird Rd., Penfield, N.Y. 14526
Ph: 716-586-3950
Price Class $170

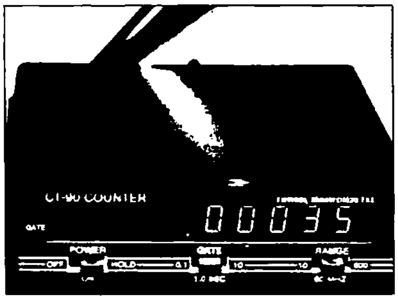
Ramsey CT-90 Review

Only a few years ago, the frequency counter was a relatively exotic instrument. Due to their high cost, counters were found only in broadcast stations, communications shops, and the like. Some fortunate hams actually had access to these hundred-pound marvels—as long as they sneaked into the shop after hours.

Times have changed. Through the miracle of VLSIC semiconductors, manufacturers are now able to produce very small, highly accurate, and easy to use test instruments at prices that are hard to believe.

The Ramsey Electronics CT-90 is just such an instrument. Priced at $169.95, the CT-90 provides all of the features of the old beige dinosaurs, and then some. The unit measures frequency from 20 Hz to 600 MHz in three overlapping ranges. Gate times of 0.1, 1.0 and 10.0 seconds are available.

The 9-digit, 0.4-inch display has lead-zero blanking and automatic decimal point placement. The CT-90 comes with a temperature-compensated 1.0 ppm time base, with a 0.1 ppm time base optional. A HOLD button is provided which lets the operator freeze the display for reference. All of these features are packed into a 5.0 x 5.0 x 1.5 inch box and powered by an internal NiCd battery—giving us a total weight of one pound!



The CT-90 Portable Frequency Counter

Using the CT-90 is simplicity itself. The desired input range (10 MHz, 60 MHz, or 600 MHz) is selected by a front panel switch. Two counter inputs are found on the back of the instrument. One BNC connector is for the 10 and 60 MHz ranges, the other is for the 600 MHz range. Should the user need assistance, the manual gives explicit instructions—even to the point of giving directions for building probes, coupling boxes, and sniffer loops. The collapsible antenna (included) mounts directly to the input connectors. Off-the-air monitoring is adequate for many applications.

The greatest feature of the CT-90 is the NiCd battery pack. The convenience of being able to pick up a frequency counter, unplug it, and carry it around the shop while making measurements cannot be emphasized enough. (Try doing that with that big beige box!)

The CT-90 Portable Frequency Counter is a useful tool in its own right, whether used for adjusting emergency AC generators, setting transmitters on frequency, or for general troubleshooting. The unit will also enhance the value of other test equipment. For instance, using the CT-90 in conjunction with a used or inexpensive signal generator will yield a highly accurate source of RF for receiver repairs.

At only $169.95, the CT-90 is the ham radio troubleshooter's next logical acquisition after the DVM.

CHOOSING A QSL CARD

Which Style and Design Reflects You Best?

by Jennifer Roe WA6OHX

One day I said to myself, "Well, it's time again for me to decide which QSL card to buy. Of course, I'd like to design the *ultimate* card which really tells the recipient all about me in just one glance—but no, I think I'd rather have a photo of me at my station. Or maybe a color picture of the green hills of Simi Valley. Gosh, what am I going to do? Possibly this time I'll pick a standard design. Oh, for heaven's sake! There are only 1001 plus "standard designs" to choose from. Now I'm in trouble! Decisions, decisions, decisions. You'd think I was making an investment in a home."

I was determined to tackle this project logically. I picked up *73*, *QST*, *World Radio*, and *CQ*, and listed all the QSL card vendors I could find. I dropped a bunch of letters in the mail requesting samples. Most of the samples arrived in the return mail (two to five days, depending on location). The responses were excellent. I laid the samples out on the floor and examined each packet carefully.

Compiling a Shopper's Comparison Table

The shopper's comparison table which appears was compiled on one contact only. I wrote and requested the samples and based all of the information on the literature and samples I received. It was a challenge to place the information in specific categories. Especially difficult were the terms "standard" and "custom" cards. Some standard cards are completely inflexible, while others have an inflexible design but choices on any or all of the following: paper (color or weight), ink color, report format, and font. Other cards are "standard" in report format and location of design and information, but there is a choice in the actual design. Oh, help! Design tastes are very individual, so I decided not to

KEY FOR TABLES

(1) I suggest that you send $.39 in stamps to help defray the vendors cost of mailing free samples. It is not requested by the vendor.
(2) The amount is applied to cost of QSL (therefore it is refundable with purchase). In some cases there is an expiration date.
(3) Shipping and handling included in price. (I assume this means USA delivery only.)
(4) 3 colors (orange, blue and white).
(5) Refundable on order over $20.
(6) Minimum order $14.
(7) ARRL logo at no extra charge.
(8) Logos included free.
(9) Extra charge.
(10) Displayed on sample. No mention in the literature.
(11) Accepts C.O.D. orders.
(12) Vendor supplies cuts, logo, font, different stock which makes the "standard card" a design-your own.
(13) Standard card or sample with a few choices such as font styles, card colors, ink color, stock, etc.
(14) Grab Bag OSL

cus = custom
std = standard
wks = weeks
hrs = hours
? = unsure
b/w = black and white

QSL COMPARISON TABLE

	Brownies' OSLs	Chester QSL Cards	Colorful QSLs	Connor	Constantine	Ebbert Graphics	Gazebo Press	Holiday Graphics
Samples	$1.00(2)	(1)	1.00(2)	(1)	$1.00(2)	.50	.50	SASE
Standard	no.(13)	26	5(13)	10(13)	yes(13)	18(13)	yes(13)	yes
Custom Printing	yes	yes	no(?)	yes	no	yes	yes	yes
Custom Artwork	yes	yes	no	no	no	no	no	yes
Photos	no	b/w,color	no	no	no	no	no	no
Other Services	no	no	no	no	no	stamp	no	masters badges, cards
Stock	gloss, semi-gloss, pearl, woodgrain (12pt)	12pt cards gloss	12pt king james glossy	90# scott index (&10pt gloss)	(10pt)	(10pt)	semi-gloss high-gloss (10pt)	–
Paper Color	5	yes	white	white	yes	white	white	–
Ink Color	11	16	4+ rainbow	4	black	4	variety	–
Standard Postcard	–	–	–	–	–	–	–	–
Logos	ARRL(7)	yes(8)	yes(9)	ARRL(7)	no	yes(9)	ARRL	yes(8)
Pricing	$14/100 (3)	$33.50/200	$59.63/250	$9.85/400	$8.00/100 (3)	$19/100	$9.97/100	$12/100
Minimum quantity	100	200 std custom	250	100 gloss 400 matt	100	100	100	100
Delivery	first-in first-out	4–5 wks cus 7–10 day standard	–	–	48 hrs variety, 2 wks single	4–6 wks	–	–
Visa/Mastercard	no	yes	no	no	no	no	no	no
Ease of Ordering	2	3+	2+	2	1	2	2–	2–
Type (Font) Styles	–	yes	yes	no	no	yes	no	yes
Written Guarantee	money back	limited	–	–	–	limited	–	–
Printing Evaluation	7	7	8	5	3	6	6	–

judge anything in that area. What I find pleasing might not appeal to others.

The following categories comprise the shopper's comparison table:

Samples: To receive samples, many vendors request the customer to send stamps, money or SASE (self-addressed stamped envelope). I recommend that even if there is no request, include 39 cents in stamps to help defray the vendor's mailing costs.

Standard: Does the vendor have a standard card? I define a standard card as a basically inflexible design. Only personal information (including logos, awards, and affiliations) is changeable. If there were standard cards in the vendor packet, I listed the quantity. If there were flexibilities, such as card or ink color, or font styles, I noted this (13). In some cases no standard cards are offered. However, in my opinion, the samples can be ordered and serve as the standard card.

Custom Printing: Does the vendor print cards from the customer's original *camera-ready* artwork? (yes/no) Camera-ready is exactly that, the master artwork from which the printer makes the negative for printing. If two-color printing is desired, there are two masters. Anything else is considered a sketch!

Custom Artwork: Can the vendor create original artwork from the customer's sketches (ideas), or can the vendor design a card from their own designs—or a combination of the two? (yes/no)

Photos: Does the vendor offer photo card printing? Photo cards can be printed in black and white (b/w) or color. Costs of black and white cards vary between $37.50 and $77.60 per 1000. Color cards vary between $189.50 and $316.37 per 1000. Read the vendor's suggestions on how to choose a photo.

Other Services: Does the vendor offer services and products in addition to QSL card printing? Examples of other services are envelope printing (env), eyeball QSL cards (cards), and rubber stamps (stamp). "Variety" refers to a number of services or products.

Stock: The paper stock available for printing the QSL cards. This can be very confusing because the standards are changing. The thickness value may be given in points (12pt is heavy, 8pt is lightweight), or in pounds (110# is heavier than 90#). The information in parenthesis () has been supplied by a local printer, not the vendor.

Paper Color: The number of colors available. White is counted as a color. If colors are evident in either samples or in the literature, but not specifically listed, "yes" appears in the table.

Ink Color: The number of colors available. Black is counted as a color. If colors are evident in either the samples or in the literature, but not specifically listed, "yes" appears in the table.

Standard Postcard: Does the card meet the new US Postal Service regulations for a postcard? (yes/-) "Yes" means that the vendor has specified that their cards meet this requirement. If not stated in the literature, a dash (-) appears in the table. This is not to infer that the vendor's cards cannot be mailed as a postcard. If you are concerned about this, check with the vendor.

Logos: Does the vendor offer a logos? ARRL, other logos and emblems, and awards may be offered by the vendor. Where I found a reference only to the ARRL logo, ARRL appears in the table. "Yes" means the ARRL logo and more. Costs for logos vary. In some instances the ARRL logo is free. When I could not find any logos mentioned or see one on the sample, "no" appears in the table. This is not to imply that the vendor doesn't have any logos available. I just didn't see any. Check this one out carefully.

Pricing: The lowest price quoted in the literature. Where there is a choice, such as $9.75 for 100 or $15 for 300, I reported the minimum amount of $9.75, not the best deal (100 for $5 with a minimum purchase of 300). The cost of shipping and handling is not included in the minimum cost unless noted with (3). Shipping costs vary with the distance of the vendor to the customer.

Minimum Quantity: This is the minimum quantity which can be ordered. It may vary by design, paper stock, or custom requirement.

Delivery: This is the delivery time quoted on the literature (assuming delivery in the USA). A few vendors do not quote a delivery time. Others state that their delivery time can be sped up with a rush charge added to the price. The method of delivery generally is mail or UPS.

Method of Payment: Does the vendor accept Visa or Mastercard orders? (yes/no) If the table says "no" the only method of payment is check or money order. Never send cash. With the exception of Raum's, none of the vendors will accept C.O.D. orders.

Ease of Ordering: (1 = poor, 2 = average, 3 = excellent) This is my judgment call. I based it on the clarity and presentation of ordering information, the existence of an order blank and return envelope, and the completeness of the order blank and/or price sheet.

Type (Font) Styles: Are there different

	KW Litho	Little Print Shop	Mac's Shack	Marv Mahre Mahra& Sons	Tha OMa Press	QSL'a by W4MPY	Raum's
Samples	2 stamps	(1)	$1(2)	SASE	.50	(1)	$1(5)
Standard	no(13)	28	12	no(12)	6(13)	7(13)	26(13)
Custom Printing	yes	yes	yes	yes	yes	yes	yes
Custom Artwork	yes	no(?)	no	yes	no	yes	no
Photos	b/w,color	no	no	no	no	b/w	b/w
Other Services	no	no	no	cards	cards	cards	no
Stock	12pt glossy matt florsecent woodgrain lightweight	high gloss (8pt)	(8pt)	pearl florescant high gloss (10pt)	gloss matt (various)	vellum bristol or semi-gloss (110# & 10pt)	glossy (10pt)
Paper Color	yes	white	white&tri-color (4)	–	8	3	yes
Ink Color	any	3	black	variety	7	3	yea
Standard Postcard	–	yes	yes	yas	–	–	–
Logos	ARRL(7)	ARRL(7)	ARRL(7)	yes(8)	ARRL(10)	yes	yes(8)
Pricing	$34.73/ 200(3)	$20/ 100(3)	$8.95/100	$29/ 100(3)	$4.50/100	$17.95/ 500	$11.25/ 100(3)
Minimum quantity	200	100	100	100	100	500	100
Delivery	3–4 wks	10 working days	3 wks	10 working days	none	10–15 working days	4-6wks cus 3 wks std
Visa/Mastercard	no	no	no	no	no	yes	no(11)
Ease of Ordering	2	2–	2+	2–	2–	3	1
Type (Font) Styles	yes	no	no	yes	yes	yes	no
Written Guarantee	–	–	–	–	–	money back	–
Printing Evaluation	8+	6	6	6	4	5	7

styles of typeface (fonts)? (yes/no) This is for "customizing" standard cards or creating custom cards. "Yes" means that the literature mentions or shows samples of different font styles. I did not consider the card samples in this instance.

Written Guarantee: The vendor's literature may mention a specific guarantee. "Money Back" means that the customer must be satisfied or the cards will be reprinted or money will be refunded. "Limited" is limited to errors made by the vendor and may be restricted to reprinting the order. Not mentioning a guarantee does not suggest that the vendor won't assume liability for his errors. A reliable vendor (and I must assume that all these are) should guarantee against vendor errors, misspellings, and typos. However, incorrect information on merchandise due to customer error is *not* covered. I recommend that orders be typed or very carefully printed. Have another person proofread the order to verify that it is readable. Be especially careful of the letters OQDVUMGJ.

Printing Evaluation: (A 1-10 scale with 1 being bad, 5 average, and 10 superior) I am not a printer. Therefore I asked a professional printer (not in competition with the QSL card vendors) to help me judge just the printing jobs. The design and layout were not considered. The evaluation was based only on the overall difficulty level of the printing task and the execution of the task itself.

Decisions, Decisions, Decisions!

There are many decisions to make before contacting a vendor:

1 How many cards do you need?
a. How many do you send out each month? (Get a minimum of one year's supply.)
2. How much can you spend?
3. Purpose of card?
General usage (one card for everything).
Special occasion card (the "show" card).
DX card (Lightweight for minimum mailing costs. The county information should be on the card and spell out the state).
4. Standard card, custom card, or photo card?
Standard cards are generally cheapest. Photo cards tend to be the most expensive.
5. What weight of card stock do you want?
Lightweight cards are cheaper to send and less expensive to print, but the heavier weight cards are less fragile.
6. Glossy or matt finish?
7. Do you want the report on the face of the card or on the back?
8. What associations are going to be listed on the card (ARRL, other national organizations, clubs, or awards)?
9. Do you want the equipment printed on the card?

Keep it Simple

QSL cards are as individual as the hams sending them. A good rule of thumb is to keep it simple. The less busy the design, the more aesthetically pleasing to the eye.

Rather than wait for the ultimate original QSL design, I recommend that the first timer pick an inexpensive, lightweight, standard-design QSL card. It gets you going quickly with minimum expense, and later the cards can serve as backup cards or DX cards. Also, you can better evaluate your needs after usage.

Be aware of hidden expenses, such as custom designs, special paper, two- and three-color runs, and additional lines of text. Logos and shipping and handling costs can also boost the basic card price. Be alert. To save money, pick a standard design, standard paper, and one ink. Stay within the line allotment of the vendor and choose the logos you want displayed very carefully. Consider picking a vendor close to your location (less mailing costs). You might be able to save on state tax on an out-of-state vendor, but if they are too far away, the cost of shipping and handling may outweigh the tax savings.

Once you have decided precisely what you want, I suggest that you submit a letter to the vendor requesting them to quote a price and delivery date on that particular design. Include a sample card (if applicable) or the artwork (either a sketch or camera-ready), specifically noting the ink colors, font types, paper color and/or weight, report format, and the quantity. You can request a quote on various quantities (i.e., 100, 250, 500, 1000) to ascertain the best deal for your budget. This gives both you and the vendor an opportunity to review the order to be sure the price is agreeable. (Retain a copy of the letter for your records.) *Do not assume anything, ask questions!* If you choose a custom card or photo card, seek out the vendor's opinion on your design and/or photo. They can give you a clue as to whether your choice will achieve the results you desire. There's nothing worse than getting stuck with 1,000 QSL cards you're unhappy with.

Take a few minutes to ponder the above questions and check the comparison table for the QSL vendors that most suit your individual needs. Don't contact just one vendor, shop around.

Check other sources of QSL cards, such as the local club or ham radio store. In my area we have a local ham who prints the club card. A nearby store offers several "standard" QSLs. Get to know what's happening locally.

Which card did I choose? I'm not telling. If you want to know, catch me on the air sometime. Do you QSL???

	Ray Evans K7HLR	Ruaprint	Samcards	Sandollar Press	Shell Printing	Bud Smith (QSL Samples)	M.Smith VE7FI Hobby Print	WB4BPD QSL's (Qua Browning)
Samples	.50¢	SASE	.25¢	SASE	(1)	$1(2)	$1(2)	(1)
Standard	no(12)	10(13)	7(13)	6	5(13)	8(13)	8	no(13)(14)
Custom Printing	no	no	no	no	no	yes	yes	yes
Custom Artwork	no	no	no	no	no	yes	no	yes
Photos	no	no	no	no	no	no	no	b/w
Other Services	no	variety	env stamp	stamp	no	no	no	no
Stock	glossy crystallon calypso (10pt)	glossy (10pt)	glossy matt (10pt)	semi-gloss (10pt)	vellum bristol (110#)	matt glossy (Various)	(various)	matt semi-gloss (110#)
Paper Color	4	standard with design	white	white	4	2	yes	by request
Ink Color	3	3	9	black	3	3	2	by request
Standard Postcard	–	–	–	–	–	–	–	–
Logos	yes(8)	ARRL(7)	yes(7)	–	ARRL(7)	yes(8)	–	yes(8)
Pricing	$25/100 (3)	$24.95/100	$15/100 (3)	$20.50/200 (3)	$8/100 (3)	$14/100 (3)	$30/250 (3)	$17.50/100
Minimum quantity	100	100	100	200	100	100	250	100
Delivery	Prompt	1–4wks	first-in first-out	3wks	2wks	2–3wks	2–3wks	3–4days
Visa/Mastercard	no	yes	no	no	yes(6)	no	no	no
Ease of Ordering	1+	3	2+	2+	3	2–	1	2–
Type (Font) Styles	yes	no	no	no	no	no	no	no
Written Guarantee	–	money back	–	–	–	–	–	–
Printing Evaluation	6	8	7	7	6+	5	4	4

THE "CREW AT 22"

Set to fight AIDS on the Air

by Joseph J. Fairclough WB2JKJ

Mike Miller N4JPG is not an AIDS sufferer, though he does have AIDS, but an AIDS fighter. Mike is a charter member of "The Classroom Net" which meets daily on 7.238 MHz at 7AM eastern standard time. Using the theme of ham radio, its purpose is to promote education and a better life for young people. Mike contracted the disease several years ago after receiving factor 8, which facilitates the clotting of blood, for mild hemophilia. At that time, unlike now, donated blood was not routinely checked for AIDS.

What is important to Mike is educating people about AIDS and dispelling the many myths surrounding it...enter WB2JKJ, the Crew at the radio club of Junior High School 22 on Manhattan's lower east side, and the Classroom Net.

For those unfamiliar with the Big Apple: the lower east side of Manhattan Island is a conglomeration of tiny streets, larger boulevards, teeming multi-story housing projects, and tenements left over from the turn of the century. Surrounded by areas of unreal wealth, Loisada or alphabet city, as it is called by its residents, is home to some of the poorest inhabitants of the city. It also has the second highest concentration of AIDS cases in the nation.

Junior High 22 is in the midst of all this, or as we like to say, "at the core of the Big Apple." At "the core," the Big Apple has its problems, but it also has its possibilities for a better life for the youngsters involved in ham radio in the classroom—with education through communication.

Our unique program at 22 is designed to promote learning among youngsters that have not been academically successful. However, one must survive to learn.

For years, kids going through the program have known Mike on the air, and have heard stories about his trips as a sea captain to far off places. Many have even spoken to him while he was at sea. They know that he supports the program with both friendship and finances, and that their friend now has this disease that everyone can talk about, but with different answers to the same urgent questions.

What to do? Get 30 or 35 kids together at a time, and have a real question and answer period on the air. That's right, smack on 7.238. The "Crew" know and trust Mike. They open up and get right answers to real questions, and at the same time educate those listening on their ham or shortwave radios. Let the kids ask anything and everything in their own language. We opened the session up to friends and community members not in the program, but brought in by the "Crew" for this special event. Ham radio is on the scene at the time of disaster, and truly, the alarming spread of AIDS through this one New York community is a disaster of monumental proportions.

It sounds like a great idea, a life saving idea, and a wonderful use of ham radio—but will it work? After the first 67 eighth and ninth graders had their first session with N4JPG in early March '88, we knew we had something. Every type of question you could imagine, from how, to why, to where, all in the language of the street, was skillfully handled by Captain Mike. The unanimous comment from the kids was "At last we got somebody that knows the real answers!" Those answers will keep coming.

Joe Fairclough WB2JKJ, originator of "Education thru Communication," and Mike Miller N4JPG are now planning for the Fall '88 term. We want to reach all 200 plus that learn via ham radio at 22, and also bring in the other schools around the country that work with our group. We want to go into Loisada and meet with kids younger and older than the "Crew" and introduce them to ham radio, then to N4JPG and the message he has to deliver. Ham radio has saved many lives over the years, and hopefully we can use it now to educate and save many more. ■

Photo A. Mike Miller N4JPG, operating from his shack in Oriental, North Carolina. He is fielding questions put to him about AIDS from the "Crew at 22."

Photo B. Kathy, sixteen and in the eighth grade, asks Mike a question about AIDS—something she "Always wanted to know but didn't know who to ask!"

73 Review *by Phil Nowak*

MFJ Enterprises, Inc.
PO Box 494
Mississippi State, MS 39762
1-800-647-1800
Retail Price: $29.95

The MFJ Gray Line DX Advantage

Are you a big gun DXer, or just a little pistol like me? With my barefoot rig and four-band vertical antenna in the backyard I need every available "advantage" to work *any* DX. How about you?

Did you stop by the MFJ booth this year at Dayton? They were demonstrating a new product for the DXer who owns an IBM PC or compatible. Unfortunately, I missed it at Dayton. Quite by chance, however, I met "Mr. MFJ," Martin F. Jue, at this year's consumer electronics show. This review is a result of that chance encounter.

Handy

The MFJ Gray Line DX Advantage is a handy little program for the IBM PC and its clones. When the program arrived in the mail, I couldn't wait to try it out. It's really easy to use. Turn on your computer, bring up your version of DOS, and select an open drive. (It's the A drive on my machine.) Insert the MFJ disk and type the command TERMINAT. That's enough to get you going. A map of the world appears on your screen. If you own a vintage PC like mine, it takes a few seconds. On a 386 machine it comes right up. The first thing you notice is the light and dark areas on the map. When daylight is longest in the midwest, the light area resembles a bell. During the short days in December, the dark area resembles a bell. Right now, during the summer, the line separating the light and dark areas resembles a sine wave. As the seasons change, so does the shape of the curve. Clever program.

The light area represents that part of the earth where the sun is shining, while the dark area represents night. The line or edge between day and night is called the gray line. Astronomers refer to this line as the terminator. According to the 1987 ARRL Radio Amateur's Handbook, "Propagation along the gray line is very efficient." You can see the gray line worldwide at a glance while running the DX Advantage. If you dig around a bit in the handbook, you'll find that this applies to the lower bands such as 160 meter, 80 meter, and 40 meter.

Feature Packed

This program has *lots* of interesting features. You can just let it run in real time, which it gets from the clock in your computer. You can sit there and watch the time change minute by minute while you work DX. You may notice your local time is incorrect. MFJ sends the program out with the local time set to Universal Coordinated Time (UTC) which may not match your local time. An example will illustrate this. I live in Chicago and start running this program at 2030 hours Central Standard Time. The map will display UTC as 2030 hours and my local time as 1530 hours, the time difference between Chicago and Greenwich, England.

There are two ways to get the local time for your city to line up with the time displayed on the map. The first way is to lie to your computer. Set its clock to UTC and everything will line up. The second way is to change the parameter file to select your time zone. I'll discuss this method later.

Don't like to wait? There's an accelerator mode that speeds up the process. Just hit the F9 function key. Each change in the display represents a six-minute real time change. The time associated with each city will increase by six minutes every time a new gray line is calculated. You can increase or decrease the interval by pressing either the plus or minus key, respectively. The interval range is from pause to one week. I kept pushing the plus key until every change represented one week in real time. It was fascinating. The display went from summer to winter in just a couple of minutes. It gave me the feeling I could tinker with time and the solar system. Move over, Dr. Who.

The function keys act as toggles. Press to start, press again to stop. Another interesting feature is the position of the sun. Function key F8 toggles it on and off. I discovered that the sun only gets as far north as Key West, Florida on the longest day of the year. This means the sun was directly overhead on June 20 at noon in Key West. After that it starts its southward journey for the rest of the year.

Files and Maps

The DX Advantage comes with three different world maps. The default map is a file named LANDMASS.MAP. This map works best in all graphic modes. The program supports the CGA, EGA, and HERCULES modes. The CGA mode has some limitations, such as lower resolution. The TIMEZONE.MAP shows all twenty-four world time zones. The LATLONG.MAP shows latitude and longitude worldwide. These maps lose something in the CGA mode.

Each map can show a combination of up to 24 cities, zones, and areas. A zone is a time zone with a label attached to it, such as the central time zone. An area is an ocean such as the Pacific. You can actually customize what you want to appear on your map display.

The TERMINAT.PAR is an ASCII file containing all the goodies the TERMINAT.EXE program uses. You can make changes to this file using a wordprocessing program. You can even change the starting and ending dates for daylight savings time. *CAUTION!* Make sure you make a backup copy of the MFJ disk before making any changes.

I use Wordstar and open TERMINAT.PAR as a non-document file. This tells the wordprocessor not to add any extra text control characters. You can tell which options the program will use because they are enclosed by "< "and " >". (Less than and greater than signs.) For example, when your program arrives, the selected time will look like TIME 0>. Remove these signs from around TIME 0 and place them around your time zone. I placed them around TIME CENTRAL to make TIME CENTRAL>. This causes your map display to function in real time for your location. It's better than lying to your computer.

Use the same technique to select a city. If your home QTH doesn't appear on the map, just look up its latitude and longitude and add it to the list of cities. Remember to enclose it with the less than (<) and greater than (>) symbols.

The DX Advantage also runs in a "pop-up" mode. Both Wordstar *and* the DX Advantage are resident in memory as I type this review. When I press the ALT key and the T key at the same time, the map appears on the screen. The ESC key returns to Wordstar or whatever else is running. I tried loading Wordstar first, but that didn't work. When I loaded the DX Advantage first, then Wordstar, everything worked as advertised. The manual does caution you about using the program in a pop-up mode. It may not work with everything that way.

The manual is well written and easy to understand. After you play with the program a few minutes, the manual will make a lot of sense.

School Tool

While the program was written for hams, it's also a fine educational tool. In a school science class, kids could see directly why days are short in winter and long in summer. Looking at the position of the sun on the map display, even very young children can understand why it's cold in winter and warm in summer. More inquisitive young minds might wonder why communication is better along the terminator. What more could you ask of a simple product? It lets the OM work that gray line DX while it teaches his kids about the real world.

Thank you, Mr. M.F.J. for sending me this product for review. I found it entertaining, useful, and educational. You can order the DX Advantage from your favorite ham store or direct from MFJ Enterprises at the above address.

Hmmm, I stayed up pretty late writing this review. Time to check the DX Advantage. Look at that, a gray line from my house to Tokyo! Konbanwa.

Continued from page 61

they have to interest all amateurs, so that's no block to anything I might want to broadcast. There isn't anything I might be able to say on the air that won't interest some amateur somewhere—right?

But let's say that RAIN takes this League attack seriously. The solution to their problem is ultra simple—all they have to do is stop "broadcasting." Note, I said nothing about their stopping transmissions. No such thing.

No, you can say just about anything you want on the air—except you can't play music (and you can even send that legally if you do it the way I say)—and not have a worry in the world about the FCC monitors getting their (and your) bowels in an uproar. Easy—instead of making it a one-way transmission, just have a shill so you'll have a two-way contact. Then you can read the toady endless bulletins, with no proscriptions—no worry about how related to amateur radio the stuff is. Duck soup.

I seriously doubt that the FCC monitors check the ham bands anymore. The FCC seems to wish we'd go away, so they don't want to waste money upsetting us over anything as trivial as a world ham broadcasting network. Heck, with some repeaters sounding worse than anything I've ever heard on CB in my life, I know the FCC is out to lunch.

The next step might be for the League to get their OBS chaps to set up camp on the RAIN frequencies—a return to the old repeater war days mindset. Yes, I know about the intentional interference prohibition. I also know there isn't a DX operator who doesn't knowingly violate that rule virtually every day he operates, so don't bleeding-heart me with that weak oar.

Has the League met its match this time? This confrontation at Dayton could be the straw which will spark a frenzy of organization by RAIN, ending up with America having two (2) national organizations. Unless the spark burns the straw, of course.

Should I sit up here in New Hampshire fanning the flames—let you and him fight? Or should I throw some cold water to separate the combatants? Should I try to take this seriously? I'm pretty adaptable, but I don't think I could manage that wild a swing.

RAIN has a very major problem. I suspect it's a fatal weakness. They have their version of the League's W1AW and OBS system up and going, but they don't have a magazine. You can't make it go for long without a magazine. Ask the old NARC boys, if any are still around.

NARC

The National Amateur Radio Council was formed soon after WWII by the phone ops to fight the League's iron-fisted opposition to expanding the phone bands. CW Forever was the League cry. Hmmm, where have I heard that before? Can't remember, but it was somewhere.

The NARC grew rapidly and crushed the League opposition, achieving its aims—the expansion of the phone bands. The 80 m and 20 m phone bands were doubled. 40 m phone was opened. The League fumed, helplessly. But once their goals were won, the NARC faded away. I wish someone would write the history of NARC. I don't recall it ever being published. It sure didn't get into *QST*, I guarantee you that.

Other than for entertainment, what information might realistically be broadcast over an amateur radio network? Well, most ham news isn't of time value, so there's no practical reason for rushing it onto the air. Most news can wait for the ham magazines. But, yes, there are some timely new items which it makes sense to broadcast.

Much of the news in the Westlink Report—$22.50/yr (26X) by first class mail, 28221 Stanley Ct. Canyon Country CA 91351—is of time value. This information is broadcast by cooperating amateurs via repeaters in virtually every locality in America. It covers late-breaking FCC news, DXpeditions, propagation reports, satellite news, hamfests, and etc.

Another good source is the W5YI Report—$23/yr (24X) Box 565101. Dallas TX 75356-5101. W5YI also runs a huge VEC network, which is driving the League crazy.

Of course we're getting into the vaunted information age now, so accumulating data is all the rage. I've catered to this penchant with the Truly Exhaustive Index to *73*. This, for the first time, makes it easy to find virtually anything published in *73* quickly and simply.

What I think is really needed is on-the-air bulletin boards. It would make it possible for any amateur to instantly access any wanted information. I'm thinking in terms of contest rules, contest results, hamfest details (like who's speaking, how much the flea market costs, ticket prices, hours), FCC rule filing dates and details, DXpedition operating times, frequencies, QSL managers, commercial and foreign intruders in our ham bands for us to monitor and complain about, satellite schedules, repeater lists, etc.

The problem with any service like this is that it costs a bundle to get the information together—plus the cost of the equipment to handle it. Since one can't charge for an over-the-air ham service, there's no one to pay the tab. If we depend on it being done voluntarily, it's unlikely to be done well or to continue for long. Catch 22. Besides, the chap with the deep pockets needed to fund such a project would undoubtedly drop dead of shock when vigorously attacked by the League, blowing the whole deal.

"If we depend on it being done voluntarily, it's unlikely to be done well or to continue for long."

Yes, when there's an emergency, an amateur radio broadcasting service could be of great benefit. It might save us from the officious self-appointed hams with Haig complexes who tend to try and take over, usually screwing things up worse than if they shut up.

It would be nice if the League could get an emergency organization set up which works. Now I admit that I'm out of touch—heck, I only get on the air a few hours a week, and I only read four other ham magazines and the two ham reports, so there may be a secret emergency network out there ready to spring into action when a hurricane, earthquake or Amtrak crash happens. If there is such, and it honestly works, I'd like some details.

The RAIN approach, from that standpoint, is a good one. No emergency system is worth anything unless it's in common everyday use. When an emergency does occur, we'll all know where to tune in, and when (if our clocks are still running), if they establish a standrd frequencies and time for broadcasts. There's a whopping earthquake scheduled for California. When it hits, where will you tune for information?

We know of one other inevitable disaster which is coming—a terrorist nuclear bomb in Manhattan. That could, like the California earthquake, come at any time and we're as helpless in preventing it. So we should get as prepared as we can. I admit that the prospect of a bunch of retired old hams grabbing their walkers to try to cope with these emergencies isn't confidence-inspiring.

So, with at least four amateur radio broadcasting networks already in action, should we get the FCC to put a lid on this? Shall we let it proliferate until we have to set aside a sub-band for ham news services?

I don't want to suggest anything which will rile the League HO chaps or my fellow League members. Hey, I'm looking forward to getting my 50-year pin this year! I sure don't want to screw that one up. You won't find a stronger League supporter than me—not even among the petrified minds of some directors.

Shouldn't I get something more than a little lapel pin after fifty years? American Express just sent me a huge coffee table book in honor of my thirty-year membership. I keep watching their ads to see if I'm going to turn up there as an unknown card holder from 1958. Not yet. Maybe I'm not unknown enough.

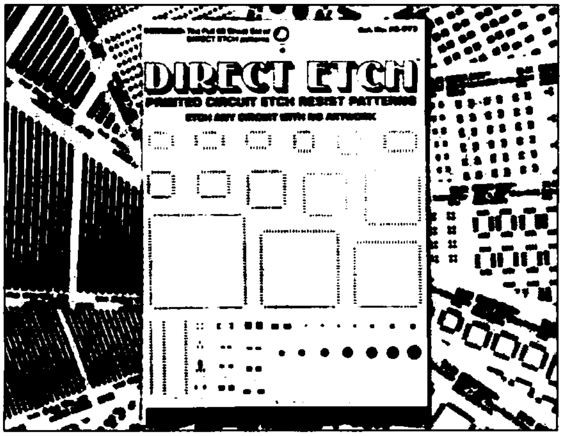
FCC Rules

Now, about the FCC rules. Let's not mess with them. If we try to favor one group or another with new rules, we'll end up with even more restrictive rules. Who knows, we could get as regulated as France, which is even worse than the USSR, when it comes to that.

You think about this ham broadcasting business for a while and then this fall I'll run an opinion poll to see what you think. Listen to the broadcasts. Let me know about any regular broadcasts or relays of broadcasts in your area so I can make a list. 73

NEW PRODUCTS

Compiled by Rebecca Niemela



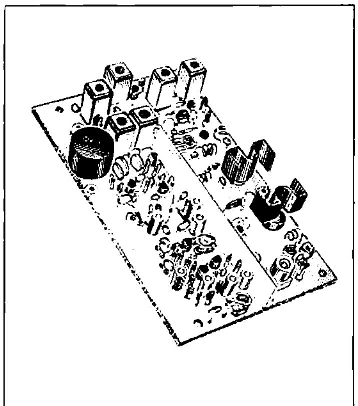
PRODUCT OF THE MONTH

DATAK CORPORATION

Direct Etch™ from Datak allows the use to try different circuit layouts without changing the master art or refabricating. To make a circuit, patterns and donuts are first rubbed down with a ball point or spoon burnisher. Connecting traces are cut to length and transferred. The final circuit is spray or tank-etched in any standard etchant. The resist is removed by soaking the board in mineral spirits, then rubbing with a soft cloth.

The DE-973 Direct Etch™ set has 69 sheets of plastic etch resist patterns that transfer by pressure directly onto a copper-clad circuit board. Patterns include DIPs, "D," edge card and DIN connectors, TOs, .050" to .250" donuts, .014" to .125" wide traces, transistors, and a wide range of surface mount patterns. Each pattern is available separately as a refill set. The DE-973 costs $34.95. Refill sets of two sheets cost $2. Call *Terry Pflueger, 201-863-7667,* or write *The DATAK Corporation, 3117 Paterson Plank Road, North Bergen NJ 07047.* For more information circle Reader Service number 201.

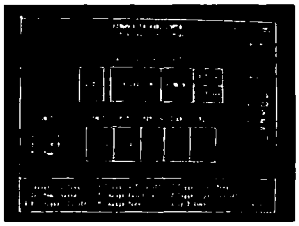
HAMTRONICS, INC.



Hamtronics has a series of transmitters for the 902–928 MHz band which complements the R901 FM Receiver. The TA901 Exciter, a version of the TA451 UHF FM, runs a minimum of 1.5W output, with doubler, driver, and output stage line-up using surface-mount microwave transistors and capacitors.

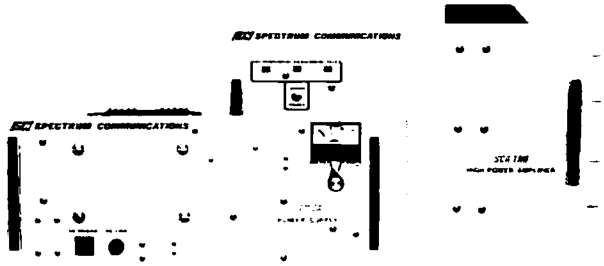
The LPA901 Power Amplifier uses a standard heatsink and broadband power module, which requires no tuning, to produce 8 to 10W output and requires only 100mW of drive from the Exciter.

The TA901 and the LPA901 are both available at $269 each, wired and tested. For more information on 900 MHz transmitters, call *Jerry Vogt at 716-392-9430.* For a catalog, send $1 for postage ($2 overseas) to *Hamtronics, Inc., 65-F Moul Rd., Hilton NY 14468-9535.* For more information circle Reader Service number 202.



RAD-COM

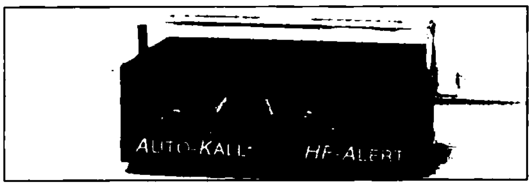
Rad-Com's Soft-Control software lets the user control the radio remotely from a PC keyboard via serial link. Using Soft-Control's simple menu, maintains the radio's memory channels, and add, delete, edit, save, and restore data from disk. Soft-Control is available now for the Kenwood TS-440S and IBM PC or compatible. Other versions will be available soon. Price, $59.95. *Rad-Com, 7958 Limewood, Pleasanton CA 94566. 415-462-4609.* For more information circle Reader Service number 203.



SPECTRUM COMMUNICATIONS CORP.

The Spectrum SCA100 150W VHF/100W UHF High Power Amplifier can be used with any 10–40W transmitter, repeater, or base station. It features massive, "behind the panel" heatsinks, automatic Hi VSWR Shutdown/"Bypass Mode" with 3x automatic reset circuit, and auto amp bypass in case of power failure or overheating. With tight RF shielding and heavy duty construction, this design includes new final transistors, which provide more stability. On 100W UHF the amplifier is available for 420–450 MHz; on 150W VHF, for 144–148 MHz. With a 30W input, the High Power Amplifier is $499 and with a 6–10W input, $640. Type accepted versions are available for commercial service.

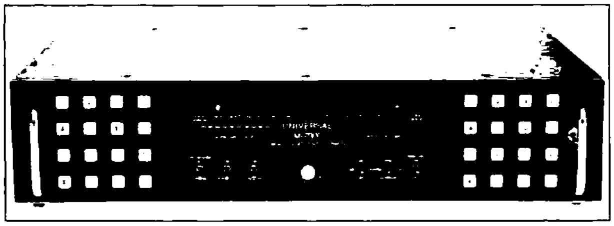
The SCP30 is the companion power supply for the SCA100 High Power Amplifier. It is heavy duty with conservative ratings, has an output of 13.8VDC @25A continuous, 30A @70% duty cycle and 115/230VAC input. The 150W/100W Amplifier with the SCP30 power supply is priced at $895. Contact *Spectrum Communications Corp., 1055 W. Germantown Pike, Norristown PA 19403-9616; 215-631-1710. TELEX 846-211.* For more information circle Reader Service number 216.



MOTRON ELECTRONICS

The MoTron Auto-Kall HF-Alert is a calling/alerting system designed for use with HF SSB/CW. It will also work on VHF/UHF, FM/AM, CB, and marine HF/VHF. 225 code combinations are possible. The HF-Alert allows the user to be contacted by radio without his having to constantly monitor the bands.

The HF-Alert comes with mobile mounting bracket, 117 VAC power supply for base operation, and an audio patch-cord. It is easily set up by connecting the patch-cord from the radio's external jack to the HF-Alert's audio input. A built-in speaker is provided or an external speaker can be used. The calling signal is sent either by directly keying a CW transmitter or by placing the microphone next to the speaker. Price, $129.95. *MoTron Electronics, 695 W. 21st Ave., Eugene OR 97405; 1-800-338-9058 or 503-687-2118.* For more information circle Reader Service number 207.



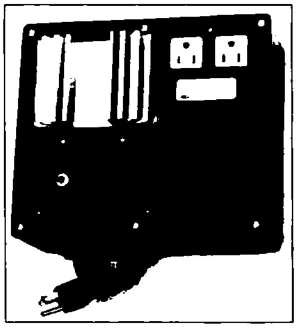
UNIVERSAL SHORTWAVE RADIO

Universal's M-7000 is a code receiver-converter that accepts multiple codes from a shortwave receiver and converts these codes into a display on a video monitor or into hard copy from a printer. It requires no computer or software.

The codes/modes supported by the M-7000 are: Morse, 5–120 wpm; Baudot, 45–250 baud; ASCII, 75–1200 baud; TOR, SITOR Modes A and B, AUTOR; ARQ, two and four channels, 86–200 baud; VFT, four modes of FDM; Three Shift, Russian Cyrillic on video; Facsimile, four drum speeds and three I.O.Cs for printout on a parallel dot matrix printer. As other codes develop, they may be added by changing ROM. Price, $999. The Real Time Clock and FAX Video Mode are available as options. For detailed specifications, call or write *Universal Shortwave Radio, 1280 Aida Drive, Reynoldsburg OH 43068; 1-800-431-3939 or 614-866-4267.* For more information circle Reader Service number 208.

ELECTRONIC SPECIALISTS, INC.

The Soft-Start AC Power series was designed for equipment with large start-up current and surge-sensitive requirements, such as large power transmitters or ultra hi-fidelity vacuum tube power amplifiers. A Soft-Stop (ramp-down) option and manually adjustable response-time option are available. Soft-Start models begin at $300. *Electronic Specialists, Inc., PO Box 389, 171 S. Main St., Natick MA 01760; 800-225-4876.* For

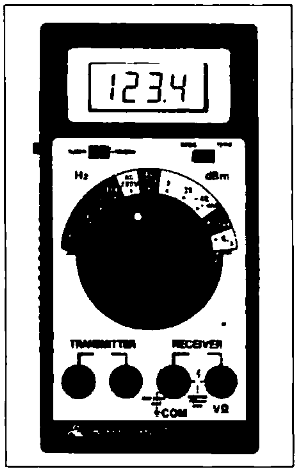


more information circle Reader Service number 205.

AMERICAN RELIANCE INC.

American Reliance announces their new Telecom Test Set, the AR-180T. It measures level, noise, AC and DC voltage, DC current, and resistance. The unit will also generate four precision tones for frequency response measurements.

For the AC voltage and level measurements, a true RMS AC converter is used. For noise measurements, the unit incorporates a built-in "C-Message" noise-weighing filter. The AR-180T is switchable between either 600Ω terminated or bridge measurements at an impedance of 1 megohm. An audible continuity beeper is included. The suggested list price is $249.95, which includes test leads, carrying case, operator's manual, battery, and spare



fuse. *American Reliance Inc., 9241 E. Valley Blvd., Rosemead CA 91770; 818-287-8400.* For more information circle Reader Service number 209.

AEROSPACE CONSULTING

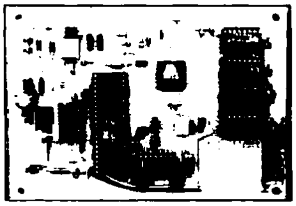
LOGWRITE is a new amateur radio logging program from Aerospace Consulting. It has a split-screen feature that allows the user to use the computer keyboard to jot down notes or copy code while using the program to keep the log book records. LOGWRITE is entirely menu-driven and fully compiled. It runs on all IBM PCs and compatibles.

Log information is entered into blocks at the top of the screen, while the rest of the screen is used for text and program prompts. The program contains a 400-line buffer. Other standard features are wordwrap and backspace-correct. The user can print, edit, and search for callsigns or prefixes, and have the time and date of contacts automatically recorded. Price, $24.95 (PA residents add $1.50 sales tax). Contact *Aerospace Consulting, PO Box 156, Gwynedd PA 19436. MasterCard and Visa orders are accepted at 1-800-345-4156, Ext. 54.* For more information circle Reader Service number 215.

QRZ INDUSTRIES

QRZ Industries introduces the Voice Box and the Mini Voice Box kits, especially designed for DXers and contesters. The Voice Box digitizes and stores an operator's natural voice, which can then be recalled. A total of 8 different phrases and operator voices can be recorded for up to 32 seconds. The Voice Box uses a 32 kHz sampling rate and several filters. It keys the PTT line to the transmitter or transceiver during playback and allows normal VOX operation. It has a switchable built-in microphone preamp to accommodate a wide variety of microphones. The audio output level to the transmitter is continuously adjustable.

Currently, the Voice Box and the Mini Voice Box are only in kit form. The kits consist of assembled, tested, working boards with

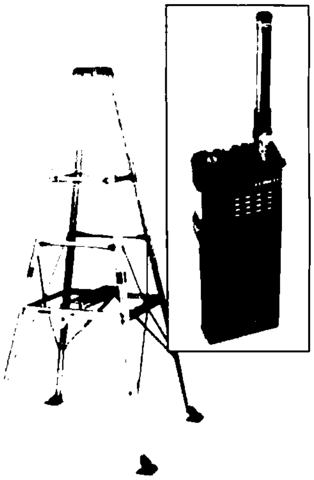


complete insructions for installing the board in a suitable enclosure. Some standard off-board components (pushbuttons, toggle switches, microphone, etc.) are required. Introductory price, $95 for the Voice Box and $55 for the Mini Voice Box kits. Add $10 for S&H, $5 for C.O.D., SC residents add 5% sales tax. Please state name of publication where seen when placing order or requesting information. *QRZ Industries, PO Box 160, Piedmont SC 29673.* For more information circle Reader Service number 210.

ALINCO ELECTRONICS, INC.

Alinco's Quad Pod was designed for the medium-size antenna system, especially light-weight HF beams, VHF/UHF antennas, and OSCAR antenna systems. With motor mounts, dual-wall construction, four guy points, steel bolts, aluminum construction, and a provision for thrust bearings, the Quad Pod is stable and durable. The ETS-150 is priced at $83 and the ETS-210 is priced at $150.

Also new from Alinco is the DJ-100T 2 meter handheld tranceiver. It has 10 memories, LCD display, dip switch programmable sub-tones, built-in converter, multiple battery packs, 16-button DTMF pad, BNC connector, and it has easily expandable frequency coverage. Price, $299. Write or call *Alinco Electronics, Inc.,*



20705 S. Western Ave., Suite 104, Torrance CA 90501; 213-618-8616. For more information circle Reader Service number 204.

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LETTERS

Number 21 on your Feedback card

QSL Correction

W3GXK is NOT the QSL manager for FP/W2NSD.

Please send all FP/W2NSD QSLs to WGE Center, Route 202 North, Peterborough NH 03458.

RTTY.BAS Program Correction

The RTTY Loop Program published in the January 1988 issue of *73* has some mistakes. In order for the program to run, there must be an @ after the word PRINT on six lines. On the line that begins with "310," place an @ after each PRINT. The other five lines are corrected as follows:

```
720 CLS:PRINT@229,
    "LOADING";A$
830 CLS:PRINT@229,
    "SAVING";A$
850 PRINT@293,"ARE YOU
    SURE(Y/N)";:INPUT S$
870 PRINT@293,":
    OPEN"O",F,A$
960 PRINT@269,";:GOTO 210
```

From the Hamshack

In addition, the bold dots on the lines that begin with "120" and "310" should be asterisks—*.

Glenn Little
Goosecreek, SC.

Congratulations!

A note to let you know that one of your subscribers (me) was selected Security Engineering Officer of the Year for 1987 by the U.S. State Department.

What is interesting is that this is the second year in a row that a ham has taken this award, which is the highest award earned in this business. Last year it was won by Ken Cosher, whose call I forget, and who is now doing the job and is on the air from Athens, Greece.

Security engineers in the State Department are responsible for everything from technical deterrence against terrorists to protecting our embassies and consulates from extremely sophisticated bugging operations. A lot of the knowledge we gain about RF as a result of amateur radio serves us very well, especially in the latter area.

Frank Bates AA6C
American Embassy, Ankara

Vote on the S

I enjoy the new column "Welcome, Newcomers!" and respect anyone who is willing to take on the responsibility of instructing newcomers. The things that are taught now are always remembered. Good and bad.

When I was preparing for my first ticket, I was strongly urged by my Elmer to avoid adding an "s" to the numbers 73 and 88. These terms are already plural and the addition of an "s" is a redundancy (and an " 's" is even worse). An "s" after 73 is no more appropriate than adding an "s" after QSB.

I have noticed since the beginning that KA1HY (now NS1B), does recommend the use of the "s" following the 88 and 73. I fear that he is teaching bad manners. Keep up the good work.

Brent Tyndall NW●T
Springfield MO

A number of readers have had similar comments. I believe the "s" is a matter of convention. Some use it, some don't. Why don't we vote on it? Send your votes in by 1 October. . . de NA5E

Number 23 on your Feedback card

ATV

Ham Television

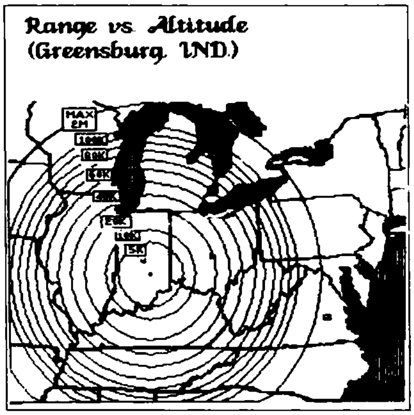


Photo A. The balloon's flight range and altitude chart.

Mike Stone WB0QCD
P.O. Box H
Lowden, IA 52255

In the real world, TV stations do occasionally go "off the air." Yes, there was no June ATV in *73 Magazine*. I hope a lot of you wrote to *73* to ask what happened. If you didn't, and if you would like to see this column continue, take pen in hand and write your comments to *73*. Thanks.

August Fast Scan TV Contest

As we move toward fall, with summer DX openings falling behind us, we find August at the peak of Fast Scan UHF TV long-range DXing. The *Spec-Com Journal* and *The USATVS* sponsor a live Fast Scan TV UHF Operation contest each year in late August. Included is some limited information about the annual FSTV contest event. Please send an SASE to me for more details or check into the Tuesday night USATVS sponsored National ATV User Net on 75 meters (3.871 MHz WB8ELK Net Control).

Hamfest and ATV Conference

It appears that we will be holding our annual Fall USATVS ATV Conference and Workshop this year in York, Pennsylvania, in cooperation with the 33rd annual York, PA Hamfest on September 24 and 25, 1988 at the York Fairgrounds. Talk-in is on 146.37/.97 or 147.93/.33 repeaters. For a flyer and additional information on the York, PA Hamfest, write York Hamfest, P.O. Box W, Dover, PA 17315, or call 717-528-8412. You may also contact ATVer John Shaffer W3SST in that area. We will have a number of ATV guest speakers at a Saturday (September 24) evening conference and possible banquet. If you are within driving distance, come over and attend our ATV Workshop sessions. The last one we had in York was a great success!

Helium Balloon Special Event Launched

The W9PRD Indiana helium filled weather balloon, carrying a two meter CW ID beacon and a 439 MHz ATV transmitter, was launched successfully from Greensburg, Indiana on Saturday June 4. Hundreds of ATVers saw the two computer generated graphic pictures designed, and the module built, by Bill Brown WB8ELK from Findley, Ohio.

Launch time was 8:59 AM, right on schedule from Germantown's private airport near St. Paul, Indiana. Power on FSTV was 1.5 watts peak on a Wyman Research transmitter. No 4.5 or on-carrier audio subcarrier was sent. ATV polarization was horizontal from a beach ball "omni" antenna. The two meter frequency for the CW beacon was at 144.340 MHz FM, and it was vertically polarized. Power on two meters was three times higher than last year's Ohio WB8ELK balloon flight, at 400 milliwatts on a Johnson HT transmitter. The balloon itself stood 6'5" in diameter on the ground and expanded to 34' at 100,000 feet. Ascent was tracked at approximately 20–25 knots at 750 feet per second. Maximum "burst" height was 120,000 to 130,000 feet at 23.6 miles upward. 87 cubic feet of helium was used at an approximate cost of $200

The capsule, a styrofoam container housing the electronic components, was 16" by 8" by 8." It weighed 2.3 pounds. With 7.5 hour lithium batteries by SAFT, it gave the unit 12–15 VDC power. This special battery can handle an improved −67 degree operating temperture over the Ohio 1987 flight. Long strips of reflective aluminum dangled below the balloon to help radar readings on a local weather radar tracking system. The balloon traveled south toward Louisville, Kentucky during its voyage (about 60 some miles from where it took off). Chase teams followed the balloon while stations from all over the country gave their sight and audio beam readings to Net Controls W9PRD, WB8ELK, WA3USG, and W9NTP on 3.871 and 7.155 MHz. The 7.155 MHz frequency drew a lot of oppostion, as it is an Advanced class and above frequency.

P3 to P4 pictures were received in Iowa at 80,000 feet 300 miles away. After the flight, WB0QCD, N9AEP, W9DNT, WD0BCE, WB0OLX, KA0JAW, and W0RPK in DesMoines reported hearing the CW ID some 450 miles away! I will list more callsigns that heard or saw the balloon with computerized pictures in next month's column. There might be another flight scheduled for late this summer or early fall. Stay tuned to 3.871.

ATV Regional DX HF Coordination

The 75 meter 3.871 MHz frequency has been a pretty popular ATV talk hotspot. The mornings and late evenings for midwest and eastern ATV Dxers is an especially good time to check out UHF band propagation and to keep in touch with each other. If you suspect or participate in a band enhancement of full-fledged opening, coordinate your DXing activities on 75 meters! 144.340 MHz FM or 144.310 MHz on SSB is also used extensively for talk communications. Until we all can agree on a General class operating frequency, 7.155 MHz is the place to be on 40 meters. To direct TV pictures in an organized manner, it is important to declare a DX Net Control in your local area.

More Slot Antenna Information Coming

In next month's column, I will cover the continued success of W9DNT and K4NHN with their Alford Slot antennas. Note that there was a serious error in the W9DNT dual Slot graphics printed a few months ago. The circumference of the Slot antenna was shown to be 4 inches. However, it has a 4-inch *diameter*—not circumference. Sony for the error.

The May 1988 issue of *The Spec-Com Journal* featured two pages on W9DNT's Slots, including a new version for the 902–928 MHz band. This information will be presented in the next issue of *73 Magazine*. You can also sign up for a subscription to The ATVers Journal, *Spec-Com*, for just $20 per year (PO Box H, Lowden IA 52255).

August Fast Scan TV Contest

If you are serious about entering and working this annual FSTV Contest, send the USATVS an SASE at the *Spec-Com* address mentioned earlier, and we will send you all the latest information about the event, including a contest entry form and logsheet! Check into the 75 meter National ATV Users Net on 3.871 MHz on Tuesday evenings for more information and updates. Many will be monitoring that frequency during the entire contest day and night for any DX openings.

The 7th Annual USATVS sponsored "North American Fast Scan TV QSO and DX Contest" will be conducted during the week of August 29 through September 4, 1988, from Monday morning (0001 Eastern time zone) to Sunday night (2400 Eastern time zone). Those in the Central, Mountain, and Pacific time zones may start the contest on the Eastern time zone start/end times. As in past years, the object of the contest is to work as many Fast Scan UHF TV stations as possible on the 420, 902, 1240 and above amateur radio bands, and to work as far as possible to obtain the best TV signal and audio transmissions. But most importantly, to have fun!

Scoring Details

The contest scoring is understandably a bit complicated, but it makes sense if you list it properly on paper. Try a few samples before actually working the contest. Contact Scoring: The USA is broken down into six zones. The geographical boundaries are used only for selecting Regional Area Winners (see USATVS Contest Information and Logsheet). Simplex contacts are highly recommended, although an ATV/R station is allowed. A substantial penalty exists for "repeater or relayed" contacts. For the first time, a special 500 points bonus exists for the promotion of "FM signal contacts!"

Initial contact Received Base score: 100 points. Color, add 50 points. Audio (of any type i.e. subcarrier, on-carrier, independent carrier, or another band, such as

two meters), add 25 points. Initial contact Transmit Base score: 100 points. Color sent and received, add 50 points. Audio sent and received, add 25 points. Add both Received and Transmit scores. Add a 500 point bonus on both the R/T signals if contact was made on true two-way FM. If AM slope detection of the transmitted FM signal is received, the receiver takes a reduced 300 point bonus (the transmitting FM station gets to claim 500 on both T/R). Deduct 50% if contact was made through a repeater. Then take this score times a Band **Multiplier** times 2 for the 900 MHz band, times three for 1240 MHz band, times four for 2300 band, etc. Finally, take this total score times a DX Multiplier in 25 mile increments: Times 2=25 plus miles, times 3=50, times 4=75, times 5=100 plus miles, etc. This will be your final score.

The USATVS suggests that when submitting your ATV Contest logsheets, list (left to right) as follows: Number of Contact, Time, Callsign, Name and Location, Miles, P/C/A Signal, Receive Base, (FM RCV Bonus), Color, Audio, Subtotal, P/C/A/ Signal, Transmit Base, (FM XMT Bonus), Color, Audio, Subtotal, Combined R/T Base Subtotal, Penalty, Subtotal, Band Multiplier, Subtotal, DX Multiplier, Final Score and Comments.

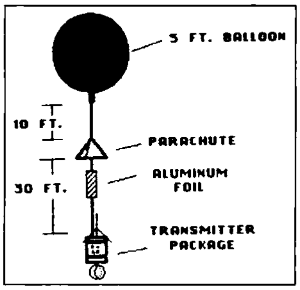


Photo B. A diagram of the W9PRD Indiana helium filled weather balloon.

Declare your station as a Single-Operator Entry or a Multi-Operator Entry (list all operators) and note your location. All TV contacts must be made on recognized UHF Fast Scan Television operating frequencies. Callsign station ID and signal report "exchanges" should be done on the TV Video picture. Use USATVS standard P-Signal, Color and Audio report signals (1–5 levels). Newly introduced, Color signal reports include C1=Weak Intermittant Color to C3=Good Locked Color to C5=Excellent bright and bold, full color. An A1–A5 Audio reading report, i.e., A1=Very weak, low-level, intermittant audio to A3=Good readable audio to A5=Full quieting audio signals, should be used. Log readings such as P5/C5/A5 may be listed and accepted on your contest logsheets.

Only one Ham-TV station per contact per band may be claimed in the logsheet, although you may work and log the station as many times as you wish to obtain the highest possible score. Circle claimed entries at the final score. A contacted station may be worked again on another band for additional contacts. Crossband contacts are allowed. All submitted logsheets must be completed in final scoring. The use of signal enhancers, color processors, preamps and amplifiers is authorized. Contacts with Remote Transmitter stations may count for receive only. Repeater contact distance must be calculated to the repeater transmitting site only, and not onto the viewed station (a possible advantage for close range stations). Absolutely verified and confirmed (on/off tested) SYNC bar sighting contacts may count as a legitimate contact. Non-video TV picture but "on-carrier" (modulated within a TV signal) may be counted for audio level scoring only).

There will no doubt be some last minute changes, so keep in touch via the 75 meter HF ATV Users Net or obtain the official USATVS ATV Contest Entry/Logbook sheet. You don't have to be a member of the USATVS or a subcriber to *The Spec-Com Journal* to enter or win this contest. All USATVS sponsored North American FSTV Contest entrants will receive framable 8" by 10" certificates! The station with the farthest verified contact wins a 1-year subscription to *Spec-Com* and certificate. First Place winners from each of the six regions will receive 2-year subscriptions and certificates of recognition. The First Place winner for the country receives a 3-year subscription to *Spec-Com*, a certificate, a trophy award wall plaque, and all fame and notoriety in *73* and *Spec-Com!* Contest postmarked log entry submission end date is September 10, 1988.

Good luck on the contest! Dust off those amplifiers, get up the biggest antenna array that your tower can handle, and have plenty of coffee! This year's annual contest promises to be one of the best ever!

Number 24 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston, TX 77083

Cinq, quatre, trois, deux, un, feu . . allumage. It's up! AMSAT OSCAR 13 is now in orbit and available for use!

On the morning of June 15th, Europe's largest Ariane launcher rose majestically from the jungles of French Guiana. Thousands of amateurs around the world monitored the launch via the AMSAT Launch Information Service on the HF bands or through VHF and UHF repeaters connected via phone lines to the network. Others saw the launch live from Kourou using C-band satellite TV dishes or on cable from C-SPAN. The live transmission direct from the launch site gave excellent information on the launch vehicle statistics with detailed descriptions of the payloads. With the AMSAT broadcasts and the available TV coverage, mission V-22 was quite a multi-media event.

Although weather was a concern in the days prior to June 15th, on the morning of the launch, skies were clear and all systems were GO. As the countdown proceeded smoothly, it looked like the launch would go off without a hitch. At just under six minutes to go, however, the countdown was stopped. A red light had come on. Seven minutes later, after a minor ground equipment misconfiguration problem had been resolved, the count continued. Listening to a countdown in French is different, but the result is the same. In a magnificent blast, the strange, yet powerful, rocket began its ascent. With a mixture of liquid and solid-fuel engines blazing and insulation panels falling away like a molting skin, the sight was impressive. Ground cameras did a good job, but the chase helicopter shots were better. All looked well for the ambitious Ariane 4 program.

There are many changes in the Ariane 4 compared to earlier Ariane launchers. They include a longer first stage, a new equipment bay, larger payload fairings, and structural improvements in the second and third stages. Several variations of the strap-on booster system allow the rocket to be configured for different payloads. Up to 8160 pounds can be sent to Geostationary Transfer Orbit. The June 15th launch included two solid-rocket boosters and two liquid-fuel types. The combined mass of the payload for this mission, V-22, was 7720 pounds. The Ariane 4 will be the workhorse for Arianespace operations through the 1990s.

At the control center, there were no congratulations and cheers until the last satellite was deployed. The HM-7 third stage engine was responsible for three of Ariane's four failures. Everything was perfect this time. The payloads were deposited into the desired GTO with exceptional accuracy. The orbit had a perigee, or low point, of 137 miles and an apogee, or high point, of 24,593 miles.

Figure 1. Final orbit after last kick motor burn. Apogee is over the equator, drifting toward the north.

Phase 3C, now A-O-13, was one of the three satellites awaiting further orbit modification. The European Space Agency's Meteosat P2 weather satellite and Pan American Satellite 1 were the primary payloads. Both were boosted to their final geostationary destinations at 10 degrees West and 45 degrees West respectively.

OSCAR-10 remained in GTO till June 22nd. AMSAT-DL, (West Germany), fired the liquid fuel kick motor while the new hamsat was at apogee over the Indian Ocean. This was the second time ever that an amateur radio satellite had fired a rocket motor in space. Many recall that AMSAT OSCAR 10's engine did not fire correctly. A wiring error caused the engine to use all the fuel in one burn.

OSCAR 13's first burn was flawless. It lasted 50 seconds and raised perigee to 680 miles. Without this maneuver, the satellite would have lasted only a few months until atmospheric drag took its toll. Even if no further orbit modifications were desired, at least the satellite was safe from an early demise.

Photo A. OSCAR 13 spaceframe in construction in Colorado.

The second burn, in early July, lasted much longer, boosting the inclination close to 57 degrees and further raising the perigee to over 1300 miles. All of the remaining fuel was used in this five minute burn. The originally planned perigee was 930 miles. Studies by AMSAT-DL showed a better perigee to be in the range between 1200 and 1500 miles. Although the proton radiation is 10–20 percent greater at the higher perigee, the electron density drops by 50 percent. This change in the final orbit also allows better coverage for those in the southern hemisphere.

Following the final burn, OSCAR 13 was spun down from 60 rpm. Both spacecraft stability during the kick-motor burns and fuel tank flushing required the high spin rate. It also helped flush the fuel tanks. Normal operation and reorientation, however, doesn't require a high rotational speed.

OSCAR 13's health is good. Telemetry reports all temperatures, voltages and currents within specification. The experience gained from the operation of OSCAR 10 allowed appropriate design modifications for the new satellite. Thermal blankets are positioned more precisely, and the new radiation-hard memory, donated by the Harris Corporation, provides 1000 times better resistance to irreversible memory damage. Onboard programming immediately logged and corrected the few "soft errors" in the memory chips caused by solar flares.

The satellite is ready for use. There was a frequency chart in the June 1988 Hamsat column. A table of the transponder frequencies can also be found in AMSAT President Vern Riportella's article "Introducing Phase 3C: A New More Versatile OSCAR" in the June 1988 issue of *QST*. The values shown will be fine tuned after the satellite's circuitry has stabilized.

Mode B downlink frequencies were used during the orbital maneuvers and testing phase of the satellite. This activity on two meters gave many a chance to listen to the newest hamsat via the general beacon on 145.812 MHz. Signals were weak because they issued from the omni-directional

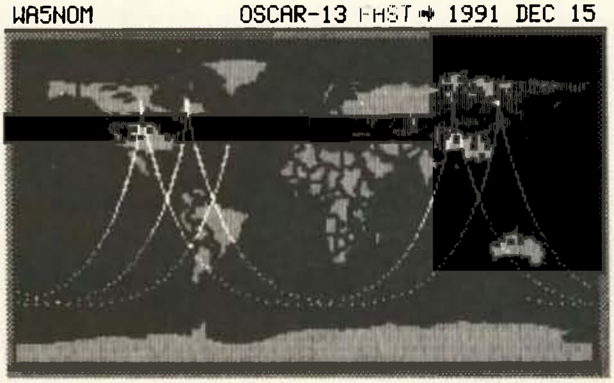


Figure 2. Three and a half years after launch. Apogee is at 57° north latitude.

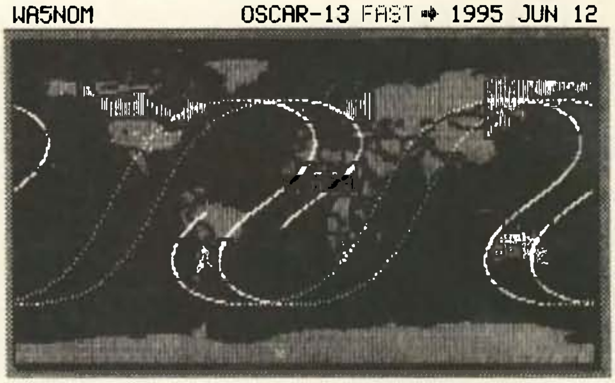


Figure 3. Seven years after launch. Apogee over the equator, drifting southward.

two-meter whip antenna instead of the gain array. When the satellite was in close, less than 13,000 miles, it was possible to copy signals using simple antennas.

Telemetry heard included 400 baud BPSK (bi-phase shift keyed), RTTY at 50 baud (set wpm to 66) and CW at 10 wpm (words per minute). The PSK data is the most common. RTTY can be heard at 15 and 45 minutes after the hour. The CW is activated at 0 and 30 minutes after the hour. The schedule can be changed whenever necessary

Most amateur stations are not set up for 400 baud PSK reception and decoding. The RTTY downlink provides data on 60 of the 64 available telemetry channels. Amateur Satellite Report number 178 gives updated details on the equation conversion values. This publication is available to members of AMSAT NA Write: PO Box 27, Washington DC 20044 for details on membership dues.

The general beacon gives information on satellite activities in addition to transmitting telemetry. Possible messages include OSCAR 10 and OSCAR 13 operating schedules and the latest information on satellite control activities and system status

Like OSCAR 10, the ground track of OSCAR 13 will change during its lifetime. For now, the apogees occur near the equator drifting to the north. In about three and a half years, they will be at their most northerly point. In December 1991, most of the northern hemisphere will have simultaneous satellite access when OSCAR 13 is at an apogee. Since the majority of the amateur population is in the northern hemisphere, activity will be at its peak and DX opportunities will be excellent. Seven years from now, the apogees will be back over the equator and trending southward. By then the satellite will have reached its operational life expectancy. Even though this may seem to be bad news, it is not. By 1995 the amateur space program should be well into developing an upgraded Phase 3 spacecraft or the first Phase 4 geostationary spacecraft.

Get ready for some great times on OSCAR 13. Well over 130 countries were active on OSCAR 10. With more VHF and UHF gear available and a more favorable orbit than on OSCAR 10, overseas activity will increase. Unlike the HF bands, DX contacts via satellite are usually relaxed. There is more conversation, with less hit-and-run activity. Come on up and enjoy the fun via satellite!

Field Day

For satellite chasers or clubs just looking for bonus points, Field Day 1988 on the hamsats was great. Our Field Day group used a KLM 14-element crossed yagi for two meters and a Cushcraft 16 element crossed yagi for 70 cm, and thoroughly enjoyed the OSCAR 10 contacts.

For RS operation via Mode A, we used the two-meter crossed yagi with 20 Watts for the uplink, while a barely functional multiband vertical with the help of a Janeil preamp pulled in the 10-meter downlink.

Although limited to Modes A and B, we logged more contacts than we had on any previous Field Day. With the potential of OSCAR 13's modes, just choosing the gear and antennas will be a chore in 1989. Let's hope so! 73

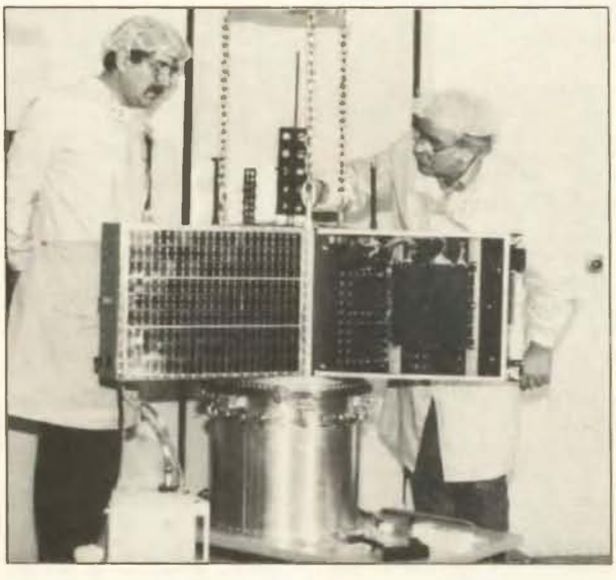


Photo B. Preparing OSCAR 13 for final tests in West Germany.

Photo C. The WA5ZIB satellite station at Field Day 1988

Dx

Hams Around the World

Chod Harris VP2ML
PO Box 4881
Santa Rosa CA 95402

United Arab Emirates - A61AB

The United Arab Emirates is a loose organization of poorly defined states on the southern end of the war-torn Persian Gulf. The UAE shares a disputed boundary with Oman on the east, and with Saudi Arabia on the south and west. As with most of the countries in the region, the UAE's economy centers around oil, and the UAE has enjoyed the prosperity that oil revenues have brought to the region. However, it remains a conservative Moslem state in many ways, despite its gleaming skyscrapers and wide thoroughfares.

A6 Very Rare On CW

Amateur radio activity from the UAE has been very scarce over the past ten years. Only a handful of operators have made contacts from A6, including A6XB in February, 1979, and A6XJC in 1983. More recently, A61AA and A61AB have been giving out coveted A61 contacts to a few deserving DXers.

In *The DX Bulletin's* 1987 Most Wanted Countries survey, the UAE ranked number 12, with 53% of responding DXers saying they needed A6. UAE steadily climbed the Most Wanted list, from 41st position in 1977, to 30th in 1980.

The UAE are even rarer on CW. Previous A61 hams seldom used CW, and neither current licensee is proficient in the mode. Of all the countries that have been on the air on CW since the start of the CW DXCC on January 1, 1975, the UAE is second only to Vietnam XV on the CW Most Wanted list.

An Opportunity

Early this year, one of the top CW operators in the world had an opportunity to do something about the demand for United Arab Emirates on CW. Jacky Calvo F2CW spent 12 days in Abu Dhabi, the capital city of the state.

In early 1988, Jacky, a veteran of a recent Clipperton DXpedition, was discussing a possible trip to Spratly 1S. When Chinese and Vietnamese ships exchanged gunfire over passage through the Spratlys, Jacky looked elsewhere for a suitable DXpedition location. In discussions with DX Hall of Fame member Kan JA1BK, the call A61AB came up.

Jacky Calvo F2CW dons Arab dress for presentation of his A61AB CW DXpedition slides, at the International DX Convention in Visalia, California.

Kalib A61AB received a donated 205BA 5-element 20-meter beam almost a year ago, and he had yet to put the antenna on his tower. Kan suggested a deal: He would arrange for the donation of a complete kilowatt station to A61AB, consisting of a Kenwood TS-440S transceiver and Kenwood amplifier, if A61AB could arrange official permission for Jacky to go to the UAE, set up the station and the antenna, and operate as long as possible.

The deal was quickly accepted, and Kan assembled, packed, and shipped the gear ahead of time to Abu Dhabi, including Jacky's CW paddle and keyer.

Initial Setbacks

Soon after his arrival in Abu Dhabi on Saturday, Jacky called his host A61AB about going to his house and operating. Jacky was especially anxious to get on the air before the end of the weekend, as more DXers can operate on the weekends than during the week. He immediately received two pieces of bad news. Kalib's schedule precluded Jacky coming over to his house to operate until late Sunday evening. Jacky would have to wait nearly 24 hours after arriving in the UAE before making his first contact.

The second disappointment was more ominous: The radio gear was still in customs. Kalib was confident that the gear could be claimed on Monday, but Jacky had visions of a delay of a few weeks, far past the time for his departure.

On this unsettling note, Jacky attempted to explore the tourist facilities of Abu Dhabi. Not speaking Arabic proved a significant handicap, but Jacky did manage to find the old-time market, now enclosed in the center of a brand-new building.

Thanks to the oil wells peppering the Persian Gulf around the island city of Abu Dhabi, the entire city is brand-new, including dozens of mosques elaborately decorated in gold, gems, and crystal. Jacky's conclusion: "No great tourist paradise."

A61AB At Last!

Finally, Sunday evening rolled around, and Jacky presented himself at the QTH of Kalib A61AB. The two amateurs inspected the 20-meter beam and home-made, self-supporting tower, but it was too late for tower work. Jacky anxiously asked if, since he couldn't work on the tower, could he operate for a while?

Kalib led Jacky to his Yaesu FT-757GX station. Jacky quickly put up a 20-meter antenna, and then looked for a key. There wasn't any! Jacky's CW keyer and paddle were still locked in customs. What to do?

Fortunately an experienced and resourceful DXpeditioner such as Jacky was not at a loss for long. As Bert 5A0A did in a similar situation, Jacky stripped two wires and started tapping them together: CO CO CO DE A61AB. "It reminded me of my first CW QSOs," Jacky said.

His sending was not up to his usual polished fist, but Jacky persevered, and quickly made his first QSO, a prearranged schedule with his sponsor JA1BK. Kan's response to the jury-rigged key: "Is that CW?"

Two hours later, Jacky put down the two pieces of wire, and headed back to his hotel, since he wasn't allowed to stay overnight in the home of his Moslem host. Jacky made 150 contacts in two hours clicking those wires together, a remarkable feat.

The Next Week

The remainder of the week passed very quickly for Jacky. He first attended to the reason for his presence: assembling, tuning, and erecting the 20-meter beam. "I rationed myself to one hour of work on the beam, and one hour of operating," he explained.

Meanwhile another major potential problem disappeared, when Kalib had no trouble getting the gear out of customs, including Jacky's keyer! By Tuesday evening, the beam was up and running. "My contract is finished," Jacky said, and then settled down to some serious operating. He would arrive at A61AB at 9 AM, and, with meal breaks, operate straight through to 10 PM, when he returned to his hotel in town.

"I had no trouble working Europe, but the path to the USA was very difficult, because the European hams would not stand by. Between the QRM, tuner-uppers, and even RTTY interference, stateside contacts were relatively few," Jacky explained at the International DX Convention in Visalia, California, in April.

"Sometimes the same operator would call again with a different call. Perhaps they don't know that I can identify amateurs by their fist. I can certainly recognize the same fist several QSOs in a row. Some of these jokers may find themselves 'not in log,'" he threatened.

The Last Weekend

Jacky received his final disappointment of the trip when he learned that he would not be able to operate during his final days in the UAE, over the weekend of March 5 and 6. His host was returning to his studies at the university 100 miles away, and under the restrictions of his guest operator privileges, Jacky was not permitted to operate A61AB unless Kalib was present.

So Jacky wrapped up his A61AB CW DXpedition on Friday evening, after making 3476 QSOs in 35 hours of actual operating time. He made almost all the QSOs on 20 meters, with a handful on 15 meters.

Upon his return to Japan, Jacky quickly answered all QSL requests. However, as of the end of May, the DXCC desk at ARRL Headquarters had not received required documentation to accept these CW A61AB cards for DXCC credit. At the Visalia convention, Jacky was confident that the appropriate paperwork would be available soon.

At Visalia, Jacky showed obvious frustration over making only 3500 contacts in 12 days in Abu Dhabi, but he did a fine job under the restrictions of his host, and he certainly pleased a lot of CW DXers.

Number 26 on your Feedback card

AERIAL VIEW

Antenna News

Arliss N. Thompson W7XU
Route 3, Box 224
Sioux Falls, SD 57106

Ground Systems for HF Verticals

"The antenna here is a vertical." So goes a commonly heard comment during QSOs on the HF bands. Although hams frequently consider the vertical a second class antenna and malign it as an antenna that "radiates equally poorly in all directions," the vertical is very effective in the proper setting. This month's Aerial View aims to dispel some of the misconceptions surrounding ground system requirements for quarter-wave vertical antennas, and give hints on optimizing vertical performance.

Q & A Time

Q. Why do vertical antennas require ground systems?

A. The ground system of a quarter-wave vertical acts as an electrical mirror image that allows that antenna to be resonant on the same frequency as an ungrounded half-wave antenna. Currents induced in the ground by the vertical radiator are returned to the base of the antenna through the ground. Since current flowing through a lossy conductor means lost power, the best ground system is a low-loss one. Low ground losses mean improved antenna efficiency. For most hams, that means an extensive ground (radial) system around the base of the antenna. A good ground system requires, in most instances, a fair amount space around the base of the antenna—often not available in settings such as city lots.

Hams also often overlook another important aspect of the ground system: its effect on a vertical's low angle of radiation. Good ground conductivity for many (up to 100!) wavelengths around the antenna is necessary to maximize low angle radiation. In most instances, however, it's impractical to extend the radial wires of a ground system to the point where they begin to significantly affect the angle of radiation—and there's also the problem of the often profound effects of the surrounding countryside on a vertical's DX performance. This relationship explains why some hams in regions of poor soil conductivity have poor results with verticals even after they installed an elaborate system of quarter-wavelength radials.

Q. How big does an effective ground plane need to be?

A. At least 120 radials, each ½-wavelength long. Such a system is obviously impossible, however, for all but a fortunate few. Ground conductivity plays an important role here—many more radials are necessary if the ground has poor conductivity (in the desert or in a typical city, for example) than if the conductivity is high (salt water). The rule of thumb is to install as many radials as possible.

Note, however, that for any given number of radials, there is an optimum length for those radials. In other words, four radials each 50 feet long are not equivalent to 20 radials that are each 10 feet long, even though 200 feet of wire is involved in both cases. N2MF (*QST*, June 1985, pp. 28-30) discussed details for optimizing radial systems in this regard. See some of his results in Table One.

Bear also in mind that, when using a vertical shorter than a quarter-wavelength, the importance of a good radial system increases. This is due to the low radiation resistance of electrically short verticals. Since efficiency is related to the ratio of radiation resistance to ground losses, it becomes increasingly important to minimize ground losses as radiation resistance drops. Owners of trap verticals take note.

Q. A good ground system sounds like a lot of work. How much difference will it actually make?

A. Based on Edward's (N2MF) work, a system of four radials, each 0.1-wavelength long, results in a signal approximately 4 dB down from a system of 100 radials that are each 0.4-wavelength long when installed over poor ground. Going to a radial system of 120 radials, each 0.5–0.6-wavelength long, doesn't improve the antenna's efficiency over that of the 0.4-wavelength, 100 radial system, but could lower the wave angle as much as 10 degrees compared to the four radial system (Devoldere, J., *Low-Band DXing*, *ARRL*, 1987, p.2-23). There's somewhat less improvement with good–excellent ground conductivity, but, for maximum performance, a radial system is almost always necessary.

". . . ground rods . . . hardly improve the RF ground at high frequencies."

Some Misconceptions

Q. How about ground rods?

A. Using a ground rod, or even several rods tied together, in place of a radial ground system is a common misconception propagated by some antenna manufacturers. While ground rods are effective DC grounds, they hardly improve the RF ground at high frequencies. They are worth a try if the ground conductivity is particularly high, or if no radial system is possible, but they are not equivalent to even a minimal radial system under most circumstances.

Q. What gauge wire should I use for the radials?

A. Since the current flowing in the ground system is divided among the various radials, wire size is unimportant if there are more than 4–6 radials. The wire may be bare or insulated (the latter will probably last longer when exposed to the elements), and should be copper whenever possible. Steel electric fence wire, although inexpensive, corrodes rapidly, and so loses its effectiveness as a conductor, when in contact with the earth.

Q. How should I install the radials?

A. Place them directly on the surface of the ground (anchored with nails or wire hooks if necessary) or bury them a few inches. They should radiate from the base of the antenna like spokes from a wheel, but, if necessary, bend the wires to conform to the space available.

Q. Isn't it true that a vertical that is ½-wavelength in height doesn't require a ground system?

A. No. A ½-wavelength tall vertical presents a high impedance at its base, so ground losses are less critical for antenna efficiency than with a ¼-wave antenna. As I mentioned above, however, the ground system serves more than one purpose. To get maximum performance from a vertical, install it in a location that exhibits good ground conductivity. If only a rudimentary radial system is possible in an area of poor soil conditions, it's likely a ½-wave vertical will be more efficient than a ¼-wave antenna. Poor conductivity in the far field, however, may prevent either antenna from being a good low angle radiator. In that case, a horizontal antenna mounted at a reasonable height above ground will likely outperform either of the verticals, even in DX applications.

Up, Up and Away

Q. What sort of ground system do I need for non-ground-mounted verticals?

A. Verticals mounted above ground are *ground-plane antennas*. If a ham can place the antenna a moderate distance above the earth, it's possible to use a simulated ground that's considerably simpler than the standard radial system used for ground-mounted antennas. A

Optimum length versus number of radials.

Number of radials	Optimum length (fraction of wavelength)
4	0.10
12	0.15
24	0.25
48	0.35
96	0.45
120	0.50

Table 1.

typical simulated ground (known as a ground plane) is four wires, each ¼-wavelength long, radiating horizontally from the base of the antenna. Together with the ¼-wavelength vertical antenna, they form a resonant -wavelength system.

While just one radial and the vertical alone would form a resonant system, other radials are needed to cancel out the horizontal component of the radiated signal. Even two radials, recommended by the installation instructions that come with some multi-band HF trap verticals, still doesn't give complete cancellation of the signal's horizontal component. Use four wires if possible.

Note also that, unlike the case with the grounded antenna, radial length is critical here. Cut the ground-plane antenna radials a ¼-wavelength.

Q. How high should I mount the ground of a ground-plane antenna?

A. The old adage, "the higher, the better," usually holds true here. If the radials of the ground plane are close to the earth or nearby structures, there may be associated losses due to capacitive coupling to those objects. Also, like horizontal antennas, its height above ground affects a ground plane antenna's angle of radiation.

> *". . . ground conductivity far from the antenna controls how well a vertical functions as a low-angle radiator."*

This explanation for this involves the summation and cancellation of the direct and ground-reflected waves at various wave angles. Various editions of the ARRL Antenna Book contain graphs and text that further explain this effect.

Take Home Messages

First, unless the antenna is located in a salt marsh or by the ocean, a properly installed ver- tical is not a limited-space an- tenna when the ground system requirements are considered. The ground plane antenna has reduced needs in that area, but, even so, its radials take up as much room as a dipole. Mounted well above ground, however, a ground-plane antenna can be a good low-angle radiator.

Second, ground conductivity far from the antenna controls how well a vertical functions as a low-angle radiator. Long radials can lower the angle of radiation by improving ground conductivity, but short radials have little effect in that regard. In short, a ham living on a small city lot may very well find more DX on his horizontal dipole than on a vertical installed with a marginal radial system, even though the vertical is commonly considered a DX antenna.

Third, ground rods are no substitute for even a few radials, let alone an extensive ground system. Going from no radials to an extensive radial system will give the same effect as more than doubling transmitter output power in areas of poor soil conductivity. If an electrically short vertical is involved, the change in performance will be even more dramatic.

Last but not least, the amateur with only two square feet of backyard and absolutely no room for radial systems or horizontal antennas should go ahead and try a vertical. It will very likely exhibit low efficiency, will not be a particularly effective DX antenna, and quite likely will "radiate equally poorly in all directions," but you *will* make contacts. Just keep its limitations in mind.

Address change

Please note my new address above. I welcome any comments and questions regarding past and future columns!

PROPAGATION

Number 27 on your Feedback Card

by Jim Gray W1XU

Jim Gray W1XU
P.O. Box 1079
Payson, AZ 85541

A Look at the Recent Past

In late June and early July (as this is being written) the Solar Flux has reached a value of 193 which is the highest since Cycle 21. Normally, you would think that this would bring spectacular DX–but not so! There are some mitigating circumstances: the time of year and the magnetic field of the earth. Unfortunately, these high values of solar flux have been accompanied by high values of the "A" index - the planetary magnetic field index. These have been running anywhere from 10 to 30, which indicates an unsettled to active magnetic field. As you know, when the earth's magnetic field is disturbed like this, HF propagation suffers. Deep fading conditions on a given path, higher than usual QRN, and some paths being closed entirely. Also, when the sun shows great activity (there have been large sun spot groups visible on the disk, frequent solar flares and proton events) the earth's ionosphere can become over-ionized! When over-ionization occurs (and this increases as the sun climbs above the horizon and peaks at local noon sun time—lasting until late afternoon) HF signals are absorbed rather than reflected/refracted. Finally, to add the icing to the cake, the earth is *farther* from the sun at this time of the year than it is in winter, although the northern hemisphere is tilted toward the sun. Longer hours of daylight mean more signal absorption over longer periods, and HF suffers accordingly. The ideal conditions of equal day and night hours (spring and fall equinoxes) are the best for HF.

The other side of the coin, of course, is the absolutely splendid effect on VHF-UHF conditions that the active sun produces. Maximum usable frequencies rise above 50 MHz, meaning that six meters is open on occasion, and indeed we have had some really good openings on six, in June and July. Rarely, but frequently enough to be exciting, auroral conditions exist during times of peak solar activity—especially flare activity—and auroral propagation in the high latitudes takes place on the two-meter band and above. To summarize the condition for the summer, VHF/UHF are above average in activity, while HF suffers badly. The one right spot for HF has been the sporadic E activity when short skip on 10, 12 and 15 meters reigns supreme in the summertime.

Outlook for September

Fortunately, this is all behind us now, and you are looking at a month when DX activity on the HF bands should be superb! The Fall Equinox approaches (September 22nd), solarflux levels and the sun spot count is higher than ever, and the high absorption levels of summer are gone. Now, you'll be having fun on all HF frequencies from 20 through 10 meters. These bands will be open until well after local darkness in the evening hours, and they will open early in the morning.

It looks like the first and last weeks of the month will be very good, while the middle two weeks will be only fair to poor. It is likely that the "A" index will remain high on many days, which is not exactly to our liking, but it's one of those things we have to expect. All evidences point to an early peak of Cycle 22, and perhaps a longer than usual period of peak activity–which may not be quite as high as in the previous cycle, but certainly high enough to provide maximum enjoyment for DXers.

October will be very good, too, from all appearances, and the various contests that month will probably set all-time records for high scores. By now, we hope you have used the summer to good advantage and that your HF antenna arrays are in place and ready for action. . . because you'll be in the middle of it this fall!

I think you'll find the bands somewhat better than this daily chart for September shows, but I'm hedging my bets a little bit in view of the somewhat unusual nature of the solar behavior for the last month or two.

It looks like the period between about the 10th and 24th will not be very good. . . but I could be very wrong. Your best plan will be to check with WWV frequently at 18 minutes past the hour to get the latest reports of A and K index values, and the Solar Flux values.

You will find that when the A index is below 10 and the Solar Flux is above 150, DX conditions should be superb. Try the other chart for a look at maximum usable frequencies to plot the best times from your area to the DX points of interest, and choose the time of day that seems most likely to produce results. You will notice that some paths will be very difficult, while others will be open for most of the day and night.

Make the best of your opportunities, and be prepared to be flexible because the days suggested to be F, P or G may not work out that way at all. I think we'll be lucky to find a correct call about 75–80% of the time.

Let me know how these forecasts are working for you. ■

SEPTEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 G
4 G	5 G	6 G	7 G	8 G–F	9 F	10 F–P
11 F–P	12 F–P	13 F–P	14 F	15 F	16 F–P	17 P
18 P	19 P–F	20 F	21 F–G	22 G	23 F	24 F–P
25 F	26 F–G	27 G	28 G	29 G–F	30 F	

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	20	20	-	-	-	15
ARGENTINA	20	[illegible]	40	40	-	-	-	-	-	10	10	15
AUSTRALIA	15	-	20	-	-	40	20	20				15
PANAMA	15	20	40*	40*	40	-	10	20	20	10	15	15
WESTERN EUROPE	40	40	40*	40	-	-	20	15	10	10	20	20
HAWAII	15	20	20	40	40	40	20	20	-	-	10	10/15
INDIA	-	-	-	-	-	-	20	20	-	-	-	-
JAPAN	15	20	-		-	-	20	20	-	-	-	15
MEXICO	15	20	40*	40*	40	-	10	20	20	10	10	15
PHILIPPINES	-	-	-	-	-	-	20	20	-	-	-	-
PUERTO RICO	15	20	40*	40*	40	-	10	20	20	10	10	15
SOUTH AFRICA	20	-	-	-	-	-	-	-	15	15	10	20
U S S R	40	40	-	-	-	-	-	15	15	20	-	-
WEST COAST	40	40	-	-	-	-	-	20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	-	-	-	-	-	-	-	-	-	-	15
ARGENTINA	15	20	20	40	40	-	-	-	-	-	10	15
AUSTRALIA	15	20	20	20	-	40	80	-	-	-	-	15
PANAMA	15	20	20	40*	40*	-	-	15	15	10	10	15
WESTERN EUROPE	-	40/80	40/80	-	-	15/20	15	15	20	20	20	-
HAWAII	15	20	20	40	40	40*	80	20	-	-	10	15
INDIA	-	-	-	-	-	-	-	20	-	-	-	-
JAPAN	15	-	-	-	-	-	-	-	-	-	-	15
MEXICO	15	20	20	40*	40*	-	-	15	15	10	10	15
PHILIPPINES	15	20	-	-	-	-	-	20	-	-	-	-
PUERTO RICO	15	20	20	40*	40*	-	-	15	15	10	10	15
SOUTH AFRICA	20	-	-	-	-	-	-	-	-	15	15	20
U S S R	-	-	-	-	-	-	-	20	15	20	-	-

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	15	20	20	20	40	40	-	-	-	15
ARGENTINA	10/15	20	20	40*	-	-	-	-	-	-	15	10/15
AUSTRALIA	10	15	15	20	20	40*	40	40*	20	20	15/20	15
PANAMA	20	20	40/20	40/20	40	-	-	20	20	15	10	10
WESTERN EUROPE	-	-	-	-	-	-	-	-	-	15/20	15/20	-
HAWAII	20	40	20/15	40	40	40*	40	40*	-	20	20	20
INDIA	15/20	15/20	-	-	-	-	-	-	20*	-	-	-
JAPAN	10/15	15	15	20	20	20	40*	40*	-	-	-	15
MEXICO	20	[illegible]	40/20	40/20	40	-	-	[illegible]	[illegible]	[illegible]	10	10
PHILIPPINES	15/20	15/20	-	-	-	-	-	20*	-	-	-	-
PUERTO RICO	[illegible]		40/20	40	40	-	-	[illegible]	[illegible]	[illegible]	10	10
SOUTH AFRICA	20	20	-	-	-	-	-	-	-	15	15	20/15
U.S.S.R	-	-	-	-	-	-	-	-	20	-	-	-
EAST COAST	40	40	-	-		-	-	20	20	20	15	40

* Possible 80 meter opening — Difficult path

Number 29 on your Feedback card

73 INTERNATIONAL

edited by Richard Phenix

The following is from the 3rd Edition (1985) of the *Amateur Radio Operational Manual* of the Radio Society of Great Britain.

Union of Soviet Socialist Republics

ITU allocation: EKA–EKZ, EMA–EOZ, ERA–ESZ, EXA–EZZ, LYA–LYZ, RAA–RZZ, UAA–UQZ, UUA–UZZ, 4JA-4LZ. Byelorussian SSR: EUA–EWZ. Latvian SSR: YLA–YLZ. Ukrainian SSR: URA–UTZ.

Callsign system: Current 1st, 2nd and 3rd class callsigns are made up of a two-letter republic prefix, a number (which is only significant in the case of RSFSR stations, where it denotes the geographical area) a letter corresponding to the administrative region and two serial letters, e.g., UB-5-M-AA. The two serial letters are AA-VZ for individual stations and WA-ZZ for club stations. N.B. Older two-letter calls do not follow these rules.

Each administrative region is also assigned a three-digit number, commonly called the *oblast number*. This is often printed on USSR QSL cards and is significant in some RSF awards.

Prefixes		Union republic
UA	RA	Russian Soviet Federated Socialist Republic (RSFSR)
UB	RB	Ukraine
UC	RC	Byelorussia (White Russia)
UD	RD	Azerbaijan
UF	RF	Georgia
UG	RG	Armenia
UH	RH	Turkmen
UI	RI	Uzbek
UJ	RJ	Tadzhik
UL	RL	Kazakh
UM	RM	Kirghiz
UO	RO	Moldavia
UP	RP	Lithuania
UQ	RQ	Latvia
UR	RR	Estonia
UT	RT	Ukraine
UV	RV	RSFSR
UW	RW	RSFSR
UY	RY	Ukraine
UZ	RZ	RSFSR (club stations)

USSR stations in Antarctica

4K1A	Molodezhnaya
4K1B	Mirny
4K1C	Vostok
4K1D	Novolazarevskaya
4K1E	Komsomolskaya
4K1F	Leningradskaya
4K1G	Bellingshausen
4K1H	Russkaya

Licence notes: Four licence classes. 1st class: all bands, 200W. 2nd class: all bands, 40W. 3rd class: 1.8, 3.5, 5, 7, 14, 28 MHz and VHF, 10W. 4th class: 1.8 MHz, 5W.
Foreign amateur operation: Apply to RSF.
National society: Radio Sport Federation of USSR, Box 88, Moscow D-362.
[Our correspondent, UA9MA, is from the Yaraslov Oblast, number 168–Ed.]

Notes From FN42

The amended, updated, draft Universal Permit Application form promised for September will now appear next month, providing that USSR material (or something else) doesn't come along . . . and slightly delayed thanks to Leonard M. Mendel K5OVC for putting us in touch with our Russian correspondent, Gennady Kolmakov, a few months ago.

The Wiesbaden Amateur Radio Club has sent a crisply efficient set of papers to amateur radio publications, the US State Department, FCC, ARRL, DARC, and others, concerning a letter from the Deutsche Bundespost FTZ office (reference S 21-3 B 3581) to the US Army Amateur Radio License Management Office, HQ, 5th Signal Command. The letter announced that US Novice class license holders will no longer be eligible to receive a reciprocal Class A license in West Germany. The Club says those operators are "the latest target of German Governmental bureaucracy" and is greatly disturbed by the implied criticism, calling it "an unprovoked attack...totally unwarranted" and an adverse decision "made without fully considering the consequences on international levels."

The WeisARC wrote a very temperate letter of protest to the FTZ apparently without effect. This in-

Basic Russian for CW QSOs
Send a true international goodwill gesture

[The following is adapted from a paper by K1KI reprinted from *In The DARC*, printed by the Dallas Amateur Radio Club. Thanks to Editor Cliff White WB5DYA for permission to use the article.]

The intent of the following is to provide a person with no knowledge of the Russian language a series of words, phrases and sentences useful for CW QSOs. Most Russian amateurs know just enough English to carry on basic QSOs (name, QTH, rig, and weather). Conversations tend to be very short, because few people know enough Russian to carry on even a basic QSO. You will find that even a few words in Russian will make QSOs a bit longer and more enjoyable, and that you will begin to get to know a few friends as a result. Even if you find some words sent back to you impossible to understand, your attempt to speak their language will be well received. Although Russian is not the native language of many of the peoples of the Soviet Union, virtually all Soviets understand it.

A Simple QSO:

- *ZDR* (abbreviation for zdrawstwujte).
  Greetings or hello.
- *Wamm signal 599.*
  Your signal is 599.
- *Moe imaa Scott.*
  My name is Scott.
- *Moj QTH Dallas.*
  My QTH is Dallas.
- *Kak slymmite?*
  How copy?
- *Znaim tolxko neskolxko predlovenij po russki.*
  I only know a few sentences in Russian.
- *Moe rig 500w i 4 element lumn.*
  My rig is 500w and a 4 element beam.
- *Povalujsta QSL. Moaa QSL wam budet.*
  Please QSL. My QSL will be coming to you.
- *Spasibo za QSQ.*
  Thanks for the QSO.
- *DSW* (abbreviation for do swidaniaa).
  Good-bye.
- *Poka.*
  So long. See you later.

Some weather words:

Weather—*pagoda*	Beautiful—*krasiwo*
Nice/good—*horommo*	Hot—*varko*
Cool—*prohladno*	Cold—*holodno*
Warm—*teplo*	Windy—*wetreno*
Rain—*dovdx*	Snow—*sneg*
5 degrees C—*5 grad*	Cloudy—*oblamnno*
Stormy—*bryno*	Sunny—*solnemnno*
Foggy—*tumanno*	Frost—*moroz*
Lightning—*molniaa*	

A Few More Russian Phrases . . .

- *Vy govorite po anglijyski?*
  Do you speak English?
- *dobryj denx. Dobroe utro.*
  Good day. Good morning.
- *Dobryj wemner. Dobroj nomnx.*
  Good evening. Good night.
- *Mne nuvno wamm QSL.*
  I need your QSL.
- *Aa ne ponimalm.*
  I don't understand.

The underlined letters represent special Russian characters and should be sent as a single character. For instance, "mm" should be sent as "dadadadah," "mn" as "dadadadit.", and "aa" as "didadidah".

One caution: Russian amateurs really are restricted in the topics they are permitted to talk about. Talking politics, religion and other "sensitive" issues is forbidden. Some stations will interpret this much more strictly than others. Remember, too, that mail in the Soviet Union may be read and censored by the authorities. Beware of what items are permitted to be received by mail, and which ones are not (stamps, money, magnetic tapes). Your post office can give you a detailed list.

Despite these caveats, there's still much that you and a Soviet ham can talk about. You will hopefully establish a close relationship with a Soviet amateur, exchange addresses, and begin to learn more about each other.

formation is given here at the request of the WeisARC so that interested readers who become fully informed on this rather complex issue may submit their own protests "to the US State Department, FCC, ARRL, DARC, German Government, FTZ and any others" where appropriate.

Whatever the outcome, it is impressive that the Weisbaden group has taken such a firm and friendly position on our behalf.

QSQing with Japan on September 15th? Be respectful if your opposite number is over 60—it's Respect for the Aged Day over there. If you are over 60, demand respect. You might get it. And send Happy (whatevers) as follows: September 1, Army Day, Chile; 3—Independence Day, Qatar (and for Brazil on the 7th; Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua, 15th; Mexico and Papua, New Guinea, 16th; Chile, 18th; Belize, 21st; and Mali, 22nd); 5—Labor (Labour) Day, USA (Canada); 9—National Liberation Day, Bulgaria; 10—National Day, Belize (and Chile, 11th; Lebanon, 22nd; Yemen Democratic Republic, 26th); 12—Revolution Day, Ethiopia; 17—National Heroes Day, Angola; 21—Federal Thanksgiving Day, Switzerland; 23—National Holiday, Saudi Arabia; 24—Anniversary of the Third Republic, Ghana, and Autumnal Equinox Day, Japan; 25—Referendum Day, Rwanda; 28—Confucius Day, Taiwan; and 30—guess who celebrates Botswana Day, today.

Roundup

El Salvador. Mario Moran Vega YS1GMV (pictured in the story by W9ELR, "San Salvador Earthquake"—April issue, p. 12) writes of the tremendous gratitude of "the YS Gang...for the massive and fast help" received from "the whole world." He writes of the difficulty of getting *73 Amateur Radio*, but says "It is worth the pain as it always [is] a great magazine." [*So why not become our official El Salvadoran correspondent and gel a free year's subscription in return for three reports per year on amateur activities in your country? Will you do this? You could then also help the ham world learn even more about Spanish customs—such as the one about which your letter reminds us.—Ed.*] He notes that the "Mario Tona YS1TG" referred to in the earthquake story is really Mario Giolitti Tona—an all-important difference since that makes him the son of both his mother (last name Giolitti) and his father (last name Tona). In the same way, YS1AZ and YS1FB are not sons of single mothers either, as is indicated by the single last name—their correct names are: Francisco Call Rosales and Francisco Dorja Rodriguez, respectively.

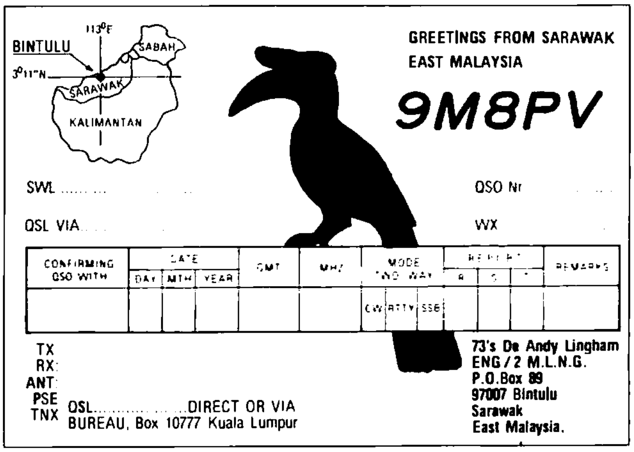
Korea (Republic of). KARL Awards for the Olympic Games, for all hams and SWLs: Class A—Contact with one 6K (special events) station and at least one with each of five HL call areas; Class B—Compose "SEOUL" with last callsign letters of HL stations, including one with 6K or any HL station with call number 88; Class C—Compose "SEOUL OLYMPICS" with last letters from any five DXCC countries, including at least one HL station. From September 1 through October 5, 6K24SO (Olympic Village), 6K88SO (Olympic Park), 6K88BYC (Busan Yacht Center), and HL88_ _ _ stations will be operating. Proofs of contacts/receptions from January through October 5, 1988, will qualify. Apply to KARL, CPO Box 162, Seoul 100, Korea, between October 1, 1988 through October 5, 1989, providing GCR plus 10 IRCs or US$5 and your QSL card. Endorsements may be applied for for specific bands, modes and other pertinent data.

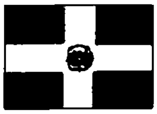
Malaysia. A greeting from Bintulu, Sarawak, from Andy 9M8PV (see photo and QSL card). Andy gets our Most Isolated QTH Award for 1988, and will retain the title thereafter until someone successfully challenges him. Bintulu, population "under 10,000," is at the mouth of the Kemena River, at the end of a secondary road from Miri (population 25–100,000), 200 km away and near the border with Brunei. Nearest town is Pandan, same size, 30 km upriver and apparently not on any road at all. The MIQTHA has been a tradition of this column since September of this year, and the Award is a year's subscription to *73 Amateur Radio* plus the privilege of writing two reports for us during the next 12 months, one to two double-spaced pages long, each. (There is no penalty for not writing them!) But do!

HI5ØØUD in December 1987. Front to back: HI3LRR, HI3MMT, HI3JMP, HI3LFE with his head turned away.

Vanuatu. The Republic of Vanuatu (an 80-island, 136,000-population archipelago 300 km west of Fiji and 150 km northeast of New Caledonia, has deposited an official instrument of accession with the International Telecommunications Union, bringing ITU membership to 164.

Sarawak's Andy 9M8PV in his QTH.





DOMINICAN REPUBLIC

Lorenzo Fernandez HI3LFE, Secretary
Union Dominicana de Radioaficionados Inc.
Seccional Santiago (HI3UD)
Apartado Postal 449-3
Santiago
Dominican Republic

On the 24th and 25th of September, HI3UD will operate portable HI4 from Tuna Key, a 1-square-km island at 19° 30+' N. Latitude and 71° 30+' W. Longitude. On December 3rd and 4th, HI5ØØUD will operate again. At both times the bands and frequencies will be as below. (These also were the same for the HI2UD transmissions June 3–5 during a DXpedition to the island reef of Saona.)

10 meters around 28,450 SSB, 28,050 CW; 15 meters around 21,250 SSB, 21,050 CW, 21,090 RTTY; 20 meters around 14,250 SSB, 14,050 CW, 14,090 RTTY; 40 meters around 7,045 SSB, 7,015 CW; 80 meters around 3,785 SSB, 3,640 CW.

A special QSL card was sent out in 1987 and different ones will be sent in each year, 1988–1992. Stations which contact HI5ØØUD every year will receive a commemorative diploma of the Fifth Centennial of the Discovery of the American Continent in 1492.

QSLs via HI8LC. ■

Number 31 on your Feedback card

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B
3335 Fieldstone Dr.
Doylestown PA 18901

FN27 . . . Yet Again!

Well, we did it. After swearing never to attempt a major multi-operator VHF contest again, and vowing not to tear my station apart for the 15th time in eight years. . . SCORE members made a return pilgrimage to Chincoteague Island for the 1988 June VHF QSO Party.

Perhaps such a return was inevitable. After last year's operation (when the equipment was modest and the band conditions anything but!), the second-guessing commenced in earnest. Could we have broken Top Ten with more power? Higher antennas? More antennas? More operators? More towers? Higher-powered operators using more antennas? The list goes on . . .

As 1987 turned into 1988, I decided enough was enough. Like General MacArthur, I foolishly stood atop the ruins of my January SS station and cried, "I shall return!"

Early Planning

The plan seemed a cinch. We'd recruit more operators, bring more aluminum, run more power, and separate the six meter station from the rest of the group by at least five miles. Seriously, we planned on bringing two tower trailers and several sections of Rohn 25 to allow more flexibility, especially on the UHF bands, where rotor control was crucial during the active hours.

By March, a more ambitious plan superseded the first. We decided to run stacked antennas on as many bands as possible—including six meters! We put in a great deal of work assembling beams and constructing H-frames in the next few months. Mike Crawford WA2VUN (whose accomplishments as a welder and tower aficionado have been well-chronicled in *73*) came up with a clever design for both the 6 and 2 meter frames, using ⅛" wall 2" diameter aluminum tubing with ⅞" stubs welded on. These stubs then slid inside the cross brace, and the assembly was secured using ⅜" X 2 ½" stainless bolts and wingnuts to prevent pinwheeling.

Antennas

Ivars Lauzums KC2PX provided virtually every antenna used from his stock of F9FT Tonna yagis. The 5-element six meter beam reviewed in the July '87 *73* was the antenna of choice for this trip. Although it's a "short" yagi with a ⅝ wavelength boom, tests showed it played very well when stacked in pairs. We reasoned it might work even better in an "H" configuration. As an added bonus, the dimensions of both the six and two meter H frames were identical . . . 12' by 12'.

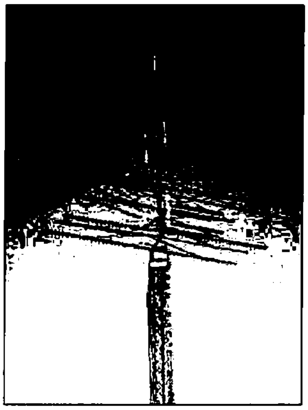


Photo A. A close-up view of the "rat's nest" tower, which contains yagis for 220, 432, 903, 1296, and 2304 MHz!

Rigs

I lined up equipment for each station. On six meters, we ran a Microwave Modules MMT 50-28 driving a 4-1000A through an intermediate amplifier. A Yaesu FT-101 was to be the IF stage. Deb Davis at ICOM made a tremendous effort to secure one of their IC-575H transceivers. It would have been an ideal test of the rig's capabilities, but circumstances and delivery dates didn't work in our favor.

An ICOM IC-275A driving a pair of 3CX800 triodes at over 1 kW output to four 17-element Tonna yagis was the 2 meter rep for the trip. Impressive in any amateur's book! 220 consisted of an IC-375A (reviewed earlier) followed by a rather impressive 8877 amplifier built by Tom Richmond WB2IEY, who agreed to come along for the effort. 220 was the only band that didn't use four yagis, as mast space limited us to a stacked pair of the new Tonna 19-element long booms.

The IC-475A driving a prototype THL-250U amplifier, courtesy of Encomm, Inc. represented 70 cm. Over 250 watts output fed four stacked Tonna 21-element yagis. We also had a Henry 2004, but felt that constant retuning of the plate line during use wouldn't be worth the extra 4 dB or so. Plus, it meant straining the 220 volt supplies to the limit!

903 consisted of an SSB Electronics LT-33S running barefoot to four 23-element Tonnas. Higher power for 33 cm was a priority for this operation, but with all the details, it slipped through the cracks.

1296 was represented by an IC-251 driving an SSB Electronics LT-23S, which in turn fed a single 7289 cavity amplifier at about 45–50 watts output. The antenna system here was by far the most impressive, with four 55-element yagis in an "H" pattern. 220 elements on 23 cm is quite a bit of aluminum!

We also had the LMW-13S transverter on 2304 with a Frontier Microwave 10 watt amplifier feeding four 25-element Tonnas. In addition to all this, Tom Hodge WA2YTM came down from Rochester with some neat gear for 3.5 and 10 GHz, using Dielectric Resonance Oscillators (DROs) for 9 cm and a pair of Gunnplexers on 10 Gigs.

Band conditions had been stellar on six for days preceding the event. A spectacular opening occurred on Monday, June 6, with openings from the east coast of the US and Canada to just about all of Europe. Ken Birmingham WB2IFC worked nearly 200 stations from Chincoteague. . . using just over 20 watts!

Dame Fortune smiled on us—Ivars located another tower trailer. This particular unit, built years ago by Trevose Electronics in Pennsylvania for emergency service, stood 100 feet tall fully cranked up. Tom Kirk KA2VAD bought it, and we spent the better part of a Saturday restringing the outside lift line to make it work.

The balance of the group was: Bill Radice K2OWR, a long-time veteran of VHF contests, Steve Katz WB2WIK, familiar to readers as the VHF editor of *CQ Magazine*, and Rich Whiten WB2OTK, one of the big guns on six meters from South Carolina. Jim Jarvis N2EA was also to come along, but unfortunately hurt his back and neck the day before.

Bill arrived first at the site on Thursday, 9 June. He set up at the Curtis Merritt Harbor area with his mobile trailer home, expecting to see the rest of the gang before midnight. Was he wrong! Our party didn't get started until nearly 9:30 PM from my house, with a van, pickup truck, station wagon, and rental truck bringing the bulk of the equipment, antennas, and accessories. I drew the unenviable assignment of towing the 100 foot beast, which had a tendency to fishtail above 50 miles/hour, so it was a slow, slow trip. . . We finally pulled in at 3:30 AM and collapsed in the mobile trailer to rest for a full day of antenna work. ■

(Continued next month.)

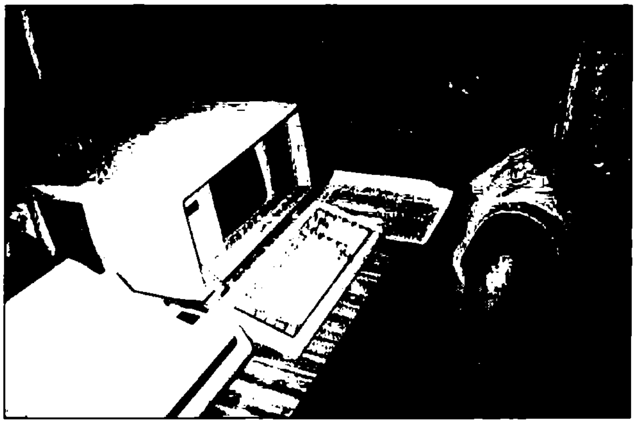


Photo B. Pete KT2B logging QSOs and updating dupe sheets on a AMQ portable PC. Using the computer allowed the contesters to produce clean logs ½ hour after the contest was over.

QTH-DX

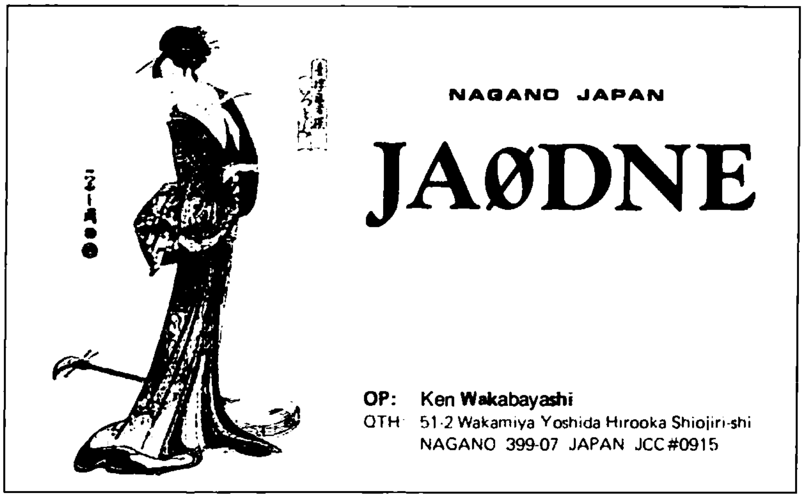
Qth is Japan

Leon Fletcher N6HYK
274 Webster Drive
Ben Lomond, CA 95005

Land of the Rising Sun

Many American hams know a fair amount about Japan (JA-JS), yet there are many surprising details about that fascinating country not widely known.

For example, while Japan's great economic growth is common knowledge, many people are not aware of the extent of that achievement. Japan leads the world in building ships, passenger cars, television sets, and radio receivers. Its rate of growth in manufacturing exceeds that of all other non-Communist countries. It is first place in daily newspaper circulation and number of television transmitters. More people use motorcycles for transportation than anywhere else. Its fishing industry is more productive than that of any other country.



Today Japan is the third richest country in the world. Some economists predict that by the year 2000, just 12 years from now, Japan will be the foremost economic power in the world.

It is also widely know that Japan is a very crowded country. It is slightly smaller than California, but has nearly five times the population. In Tokyo, the typical couple lives in a two-room apartment of only 400 square feet. In suburbia, the average family lives in a house about the size of one of our two-car garages. But Japan also leads the world in the rate of housing construction.

Despite such cramped living quarters, Japan ranks first among larger countries on the "Physical Quality of Life Index." Even so, it also leads the world in the consumption of alcoholic beverages.

Behind those rankings, which were reported in George Kurian's *New Book of World Rankings*, are Japan's well-known, but unusual, management techniques. In many firms employees start every workday by enthusiastically participating in what Americans call "pep rallies." Workers motivate themselves to greater output by chanting slogans, poems, and songs. Typical is the company hymn, "Grow, Matsushita, Grow, Grow, Grow."

In addition, in many Japanese companies, all employees at all levels, from the newest laborers to veteran executives, participate in decision making. In their view, the decision itself is not as important as insuring that everyone is informed and committed.

While many Americans have heard about these curious processes, fewer know that the techniques have been unified in a system of management called "Theory Z." Theory Z was named by an American management consultant, William Ouchi. He says the theory is based on the concept "that involved workers are the key to increased productivity."

Many Americans know that this theory is now being used in various forms and degrees by some of our own companies. The diversity of those firms is surprising: They include Hewlett-Packard, Intel, Rockwell International, United Motors, and others.

The Japanese have also incorporated innovations into their agriculture. The typical Japanese farm covers only 2.5 acres. At the start of this century, the country produced only 80 percent of the food needed by its residents. Today, Japanese farmers use scientific methods and chemical fertilizers, making the country self-sufficient in rice, and nearly so in fruits and vegetables.

It is also well known that education is afforded major emphasis in Japan. According to the editors of the Time-Life book, *Japan*, the Japanese are "the world's most educated people." Although attendance is not required, more than 90 percent of Japanese youth graduate from high school. (In the United States, only 44.7 percent of our youth complete four years of high school.) On tests taken by students in 19 industrialized countries, the Japanese scored highest on most subjects.

To help insure academic achievement, Japan has more than 20,000 private schools specializing in preparing youngsters for the tough high school entrance exams. They attend these private schools every morning before going to their regular schools, or late in the afternoon and early evening, and many return for still more concentrated study. Some of these schools even have dormitories for students who study too late at night to return home.

It is generally known that the Japanese are big on proverbs, but it is less well known that many of their wordings, which seem so quaint to Americans, are in essence quite common proverbs in our country. For example: The Japanese say, "Ichi ni yojo, ni ni kusri," which translates as "Sanitation first, medicine next." We say, "An ounce of prevention is worth a pound of cure." They say, "Hotoke-no-kao mo sando," meaning "Even Buddha is provoked upon being importuned three times." We say, "Even a worm will turn."

Hamming in Japan also provides some surprises. For example, when 20 meters is open to the Orient, there are so many Japanese on the air that many American operators get the impression that almost everyone in Japan must be a ham. Actually, there are only 33,043 Japanese hams, or one out of every 3,674 residents, which is about one-seventh of the United States' ratio of one ham for every 544 residents. But as the typical US DXer knows, Japanese hams are persistent, diligent, and committed. They love to contest. They compete with a vengeance. They chase QSL cards like gold.

Yet apparently few American hams realize that the skills in speaking English so many Japanese hams demonstrate often come not from real knowledge of our language, but from weekend cram courses which specialize in teaching just enough English to handle bare-boned QSOs.

As previously noted, some economists predict that by the year 2000, Japan will be the foremost economic power in the world. In preparation for that era, Japan is planning several "mega-projects." On a 1,100 acre landfill in Tokyo Bay, a "subcity" of 24 highrise buildings, condos, and shopping centers will be built for 44,000 residents and 115,000 workers. Nearby, a 245-acre man-made island will provide the headquarters for international satellite communications. A $6.4 billion roadway crossing the bay will include the world's longest bridge and the world's longest underwater tunnel. Ashore, Japan intends to build some 3,700 miles of new roads, more than 50 commuter airports, and 15 international airports.

All that does not include the tunnel and bridge completed this year which, for the first time, have tied together Japan's four major islands.

But DXers should really cheer for Japan's most spectacular proposal ever: the construction of an island 270 miles square, larger than Singapore and Hong Kong combined. The island would provide homes for about a million people, and would be an independent new country! ■

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R-390A Receiver Parts: info SASE. CPRC-26 military Manpack Radio, 6 meter FM, with antenna, crystal, handset: $22.50, $42.50/pair. Military-spec TS-352 Voltohm/Multimeter, leads, manual: $12.50. $4.50/piece shipping, $9 maximum. Baytronics, PO Box 591, Sandusky, OH 44870. BNB763

1988 "**Blossomland Blast**" Sunday, October 2, 1988. Write "Blast," P.O. Box 175, St.Joseph, MI 49085. BNB764

WANTED: Hallicrafter SX-117 Receiver in good, bad or partially complete condition, write Joe Karr N9FAU, 3800 Cheyenne Ct., Racine, WI 53404. BNB765

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WANTED: Allied Radio AX-190, SX-190, All Knight-Kits, Manuals, Lafayette CB, S.W., Ham. Hallicrafters SX-133 with R-51 Speaker, HA-19 Cal., HT-33B Linear Amp., Hammarlund HQ-180 with S-200 Speaker. Allied, Lafayette, Heath, Radio Shack Catalogs., *QST Magazines* 1920-1929 with yearly Handbook. Anthony J. Mignogna, 25432 Second Street, El Toro, CA 92630. BNB776

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WANT *73 MAGAZINE* JAN. 1961, DEC 1964 issues. W9SS, 5006 N. Second St., Loves Park, IL 61111-5809. BNB779

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WANTED: *Microwave Systems News* (MSN) *RF Design* and *QEX* Magazines (1980-present). Call collect 519-742-4594 (Ontario) after 6PM Eastern time. BNB781

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Continued from page 12

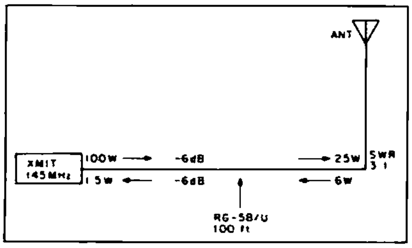

Figure 9. This is the loss analysis for the arrangement in Figure 8.

Why are reports from the fringes improved with the higher SWR antenna with the radials?

A knowledgeable member of the committee examined the data that was gathered and reasoned that without the radials the total impedance that the whole antenna system saw was a simple impedance divider consisting of the antenna impedance of 25Ω and the ground resistance of 25Ω. This situation is the same situation that exists with *any* divider. Therefore, 50 percent of Joe's radiating power was being radiated by the antenna into the ether and 50 percent was going into heating up the ground. When the radials were installed the ground resistance went to zero, essentially and the load that the antenna system saw consisted only of the antenna impedance. Since the antenna impedance was 25Ω, working in a 50Ω system the SWR had to come out to be 50:25 or 2:1. The major difference being that all of the transmitter power output was going into antenna radiation *except* for losses in the transmission line.

The Bottom Line

What were the actual powers radiated in each of these instances?

The power output of Joe's rig was 100 watts as measured into a dummy load. In order to get to the antenna, Joe had to run 100 feet of RG 8/U.

From the chart,the loss per 100 feet of RG 8/U at 7.0 MHz is 0.42 dB. This means that when Joe's transmitter output of 100 watts gets to the antenna, there is only 90.9 watts left. The rest is lost in the coax. In the first instance when Joe was operating without radials with an SWR of 1:1, a 25Ω RF ground return, 50% of his usable power went into the ground, or a loss of an additional 3.0 dB for a total loss of 3.42 dB.

When Joe was operating without radials and a good SWR his total radiated power was down to 45.5 watts from his original 100 watts.

When ground radials were installed the forward line loss of 0.42 dB still existed. The only other loss experienced was an additional loss due to the 2:1 SWR. What does this mean?

The incident power wave suffers a loss due to transmission line attenuation. In an unmatched antenna system there is an additional loss that the *reflected* power wave suffers in its travel from the antenna back to the transmitter end of the transmission line. The additional loss amounts to about 0.11 dB (from the graph for a total loss of 0.53 dB.

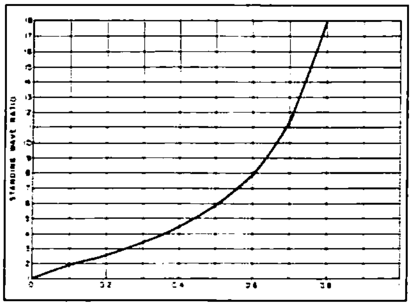

Figure 10. Ratio of reflected power based on SWR.

When Joe was operating with radials and experiencing the higher SWR his radiated power was 88.5 watts. Compare this with the 45.5 watts from an antenna system with an SWR of 1:1. How can this be? Isn't reflected power lost and dissipated in the finals of the transmitter?

The answer to both of these questions is "No." As stated earlier, as long as you can provide a conjugate match with the transmitter output tuning or other matching circuit (Transmatch), the impedance that the reflected wave sees at the transmitter end of the transmission line is $0 \pm jX$. No power is absorbed. It looks like a short circuit where the electric field collapses and the magnetic field increases. This causes total re reflection of the reflected wave back towards the antenna and is additive to the transmitter supplied power. The reflected power wave never reaches the finals. The reflected wave *does* cause a change in the input impedance of the antenna system that must be tuned out. If this is not done, the finals will dissipate power that it cannot deliver to the antenna system due to a mismatch between the transmitter and the antenna system.

Feedline Radiation

What about feed line radiation with the higher SWR?

Hogwash! The feed line is completely enclosed in the outer shield of the coax. One way a feed line can radiate, and not to any significant amount, is for the transmission line to be asymmetrically placed with relation to the antenna. If Joe had wrapped his coax around the radiating element, a current would have been induced in the outer skin of the shield.

Another way a feed line can radiate is when the currents in the two conductors are unequal. This happens when you feed a balanced antenna with unbalanced transmission line. Feeding an inverted V directly with coax is the most common situation of this type of condition. The cures are either to use a balun (explained later), or to detune the transmission line by selecting line lengths from the *ARRL Antenna Book*, Chapter 3, Fig. 3-49. But this has no relationship to the SWR. The only time feed lines radiate is when something else is wrong.

A True Story

Another scenario follows. This is a true story and it concerns an antenna situation at the QTH of a fellow amateur. It shows the relative unimportance of SWR as a standalone entity.

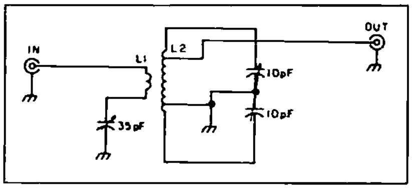

Figure 11. VHF transmatch.

This fellow is interested in packet. And since packet is usually operated simplex on VHF, he decided to run a lot of power: 100 watts. An 8–9 year old Ringo Ranger was on his roof and was fed with 100 feet of RG 58/U. After some power supply agonies, we got the rig on the air and measured an SWR of 1.2:1 at the input to the transmission line. We were encouraged, just like Joe Ham. Since the antenna and connectors had been exposed for a long time, I suggested an up close inspection. We took the SWR meter with us and hooked it up right at the base of the antenna. The transmitter was turned on and the SWR measured 3:1 between the antenna and the feed line. How can this be? The SWR was so good at the input end and so bad at the antenna transmission line junction. I got out the ARRL Antenna Book and on page 76, lo and behold, there appeared almost the exact situation that we had. It was surprising to me that the loss in 100 feet of RG 58/U at 150 MHz is 6dB. Refer to Figure 6 to see that RG 58/U is not very good at these frequencies.

Of the original 100 watts in, only 25 watts reached the antenna. The rest was dissipated in the coax.

From Figure 10 it can be seen that a mismatch of 3:1 means that 24% of the power will be reflected, or 0.24 X 25 watts = 6 watts. Of the 25 watts reaching the antenna, 6 watts would be reflected. In its travel from the antenna back to the input, this 6 watts will see the same 6dB attenuation as the incident wave. So 6 watts attenuated by 6dB means that 1.5 watts arrives back at the input as the measured reflected power wave. 100 watts measured going in and 1.5 watts measured coming back yield an SWR of 1.2:1.

The cure? Replace the RG 58/U with lower loss cable, such as RG 8/U, to reduce the line losses and use a VHF Transmatch to accommodate the mismatch at the antenna.

By itself the SWR looked excellent. But by itself the SWR is by *no* means a measure of antenna system efficiency.

Insertion Loss

You don't get something for nothing. Adding a Transmatch, or any kind of matching device will cost you. The cost is called "insertion loss" and it means exactly what it says. If you insert something in the antenna system, there is a price to pay.

The widely used Transmatch insertion loss has been pegged at 3% by Lew McCoy, the inventor. Other types of antenna tuners will probably be about the same. [Part two in next month's issue of *73*]

Number 34 on your Feedback card

SPECIAL EVENTS

Ham Doings Across the Country

PUSAN KOREA
SEP 1–OCT 5

During the Seoul Olympic Games, the Pusan Kyong Nam Branch of KARL will be operating 6K88BYC tor members of KARL, Olympic participants, and visiting hams. There are special awards for the three classes: A = HL5AP, B = HL88AP, C = HL5AP and HL88AP. Contact *Byong-joo Cho HL5AP, P.O. Box 4, Haeundae, Postal No. 612-600, Pusan, Korea. C.C.*

ANAHEIM CA
SEP 2–4

Hamcon 88, sponsored by the Orange County Council of Amateur Radio Organizations, will be held at the Disneyland Hotel. The convention includes technical sessions and forums, VEC exams, Woulf Hong, banquet, Sunday T-hunt, and the latest equipment. Contact *Hamcon Inc., PO Box 3695, Huntington Beach CA 92605.*

TITUSVILLE PA
SEP 3–4

N3GCN will operate from Titusville, Pennsylvannia, from 1400Z to 2230Z daily to commemorate the 3rd year of the Oil Creek and Titusville Railroad. Suggested frequencies are CW: lower 25 kHz of Novice subbands; SSB: lower 25 kHz of General bands 80 to 15; also Novice SSB 28.350. For special QSL send SASE or IRCs to *N3GCN/OL2T, RFD 1, Box 143-G, Titusville PA 16354. DX: QSL to K3HWL, c/o 3rd District QSL Bureau.*

WATERFORD CT
SEP 3–5

The Tri-City ARC will operate KA1BB from the Waterford, Connecticut I-95 weigh station to promote safe Labor Day driving. This is in conjunction with the 6th annual Stay-Awake Coffee Stop offered by BSA Troop 24, Niantic, CT. Operation will be from 1700Z to 2300Z in the middle of the 80, 40, 20, and 15 meter general class phone and CW bands. Talk-in to Coffee Stop on FM 146.52 direct and CB Channel 19. QSL with SASE via *Tri-City ARC, PO Box 686, Groton CT 06340.* For information, contact *Bob Dargel KA1BB, 8 Willow Lane, East Lyme CT 06333; 203-739-8016/1300.*

SAN MATEO CA
SEP 3–9

The San Mateo RC, station W6LMN operating as W200LMN, will celebrate the 200th anniversary of the US Constitution. It will operate all modes and bands from 1500Z to 0500Z daily on the beginning date until 2359Z on September 9. For a QSL, send your QSL and a large SASE to *W6LMN Trustee, PO Box 751, San Mateo CA 94401.*

ORANGE CA
SEP 3–9

The Rockwell (Autonetics Electronics Systems) RC will operate WB200YPX to celebrate the anniversary of the Constitution. Suggested frequencies: 25 kHz from low end of general phone bands; 50 kHz from low end of CW bands; Novice CW—7.115, 21.115, 28.115. Special QSL card for SASE to *Dan Violette KI6X, 1122 E. Sail Ave., Orange CA 92665.*

ATLANTIC CITY NJ
SEP 7–10

Southern Counties ARA will operate K2BR from the Miss America Pageant on the suggested frequencies: Phone, 25 kHz inside lower general class band; CW, 65 kHz lower band; and Novice, 28.100–28.500 MHz. For QSL, send an SASE #10 via *SCARA, PO Box 121, Linwood NJ 08221.*

PUT-IN-BAY OH
SEP 9–11

The Oliver Hazard Perry Expeditionary Force will occupy Perry's Victory and International Peace Memorial to commemorate the 175th anniversary of The Battle of Lake Erie and Canadian-American peace and friendship. WD8LKI will operate on suggested frequencies 28.365, 21.365, 14.265, 7.265, and 3.965 MHz. For certificate, send QSL and large SASE to *Como. Wills, 30372 Bates Road, Perrysburg OH 43551-3828.*

UNIONTOWN PA
SEP 10

Uniontown ARC W3PIE, celebrating its 50th year, will hold its 39th Annual Gabfest on the Club grounds. Registration, $3 each or two for $5. Talk-in on 147.045/.645 and 145.17/144.57. *U.A.R.C. Gabfest, %John T. Cermak WB3DOD, PO Box 433, Republic PA 15475. 412-246-2870.*

BOONE IA
SEP 10

The Boone A.R.E.S. will operate K0CY from 1400Z to 2300Z in conjunction with the 12th annual "Pufferbilly Days" commemorating the railroad. Frequencies: 7.260, 14.300, 28.385, 145.01 packet, and 146.25/.85 RPT. For QSL, send SASE and QSL to *Pufferbilly QSL, PO Box 127, Boone IA 50036.*

TUSCALOOSA AL
SEP 10

Using callsign KC4GS, the West Alabama ARS will operate a special event station honoring college football and coach Paul "Bear" Bryant. The club will operate in the bottom 25 kHz of the general 80–40–20–15 meter bands and monitor the club repeater on 147.90/.30 MHz. QSL and SASE for 8½ x 11 certificate to *WAARS (Bear Station), PO Box 1741, Tuscaloosa AL 35403 or callbook address of WD4DAT.*

MILFORD CT
SEP 10

The Greater Bridgeport ARC will operate WA1RJI at the 17th annual Engine 260 Antique Fire Apparatus Show and Muster at Eisenhower Park. Phone frequency, 14.300 from 1400Z to 2200Z. For special certificate, send 9 x 12 SASE to *GBARC, %Sterling House Community Center, 2283 Main St., Stratford CT 06497.*

STIRLING NJ
SEP 11

The Tri-County Radio Association is sponsoring their annual indoor Hamfest/Flea Market from 8 AM to 3 PM in the Passaic Township Community Center. Cost $3, tables $8 ($10 with power), reserved tailgating. Talk-in on 147.855/.255, 146.52, and 444.975/.449/.975. Call *Dick Franklin W2EUF, 201-232-5955* or write *POB 182, Westfield NJ 07090.*

MILTON WI
SEP 11

The Tri-County ARC W9MQB will hold its 2nd annual Fall-Fest from 7 AM to 2 PM outdoors by the Black Hawk Technical College between Janesville and Beloit. Admission, $2. Bring your own tables. Talk-in on 144.85/145.45. *Tri-County ARC, PO Box 321, Milton WI 53563.*

JOLIET IL
SEP 11

The Bolingbrook ARC will hold its 4th annual Ham/Computerfest at the Inwood Recreation Center in Joliet. Indoor and outdoor displays, with VEC testing, seminars, dealers, guest speakers. Talk-in on 147.33 and 224.54. Contact *Ed Weinstein WD9AYR, 7511 Walnut, Woodridge IL 60517; 312-985-0527.*

BUTLER PA
SEP 11

The Butler Hamfest will be at the Butler Farm Show Grounds from 9 AM to 4 PM. Huge outdoor flea market with free set-up. Tables and space indoors for vendors. Food, prizes, parking. Contact *John Varljen K3HJH, 174 Oak Hills Hts., Butler PA 16001; 412-283-9403.*

LAPORTE IN
SEP 11

The LaPorte and Michigan City ARCs will hold their Summer Hamfest at the Fairgrounds. Inside tables, tailgating. Talk-in on 146.52. For information and registration, contact *LaPorte ARC, PO Box 30, LaPorte IN 46350.* For table reservations, contact *Tom KA9ZUM, same address.*

LOS ANGELES CA
SEP 15–OCT 2

Special event station W6LAF, sponsored by the L.A. Area Council of ARCs, will be on the air 1700–0500 UTC from the L.A. County Fair. Suggested frequencies: 3900, 7250, 14250, 21350, 28450 plus two meter packet and phone, 220 phone and 440 ATV and phone. Announcements will be via the W6FXN repeater 145.460 and the LAACARC. For embossed certificate with the fair logo and theme "Making Tracks," send QSL and 45 cents in stamps to *W6LAF, PO Box 1770, Covina CA 91722.*

SANTA ROSA CA
SEP 17

The 6th annual SCRA Ham Radio flea market, formerly held in Sebastopol, is in Santa Rosa this year. Free admission. Tables, $7 at door, $5 in advance. VEC exams, exhibits, radio clinic, door prizes, auction. *Sonoma County Radio Amateurs, Inc., Box II6, Santa Rosa CA 95402.*

WICHITA FALLS TX
SEP 17

The Wichita ARS will have a "Swap 'Til You Drop" Hamfest from 7 AM to 6 PM. Flea market, exhibitors, VEC exams. Tickets $7 at door, $6 in advance. *WARS Hamfest, PO Box 4363, Wichita Falls TX 76308.*

BARRIE ONTARIO
SEP 17

The theme of the Packet Radio Symposium, sponsored by Hex-9 Barrie ARC, is "Educate for 88." Basic packet operation. Talk-in on 146.25/146.85 VE3LSR. Inquire *Hex-9 Group, Box 254, Barrie, Ontario CANADA L4M 4T2.* $5 pre-register via packet *VE3FJB-1.*

NEW KENSINGTON PA
SEP 18

The Skyview ARS K3MJW Hamfest will feature prizes and flea market. Talk-in on 146.04/.64. Admission $2. For more information, contact *John Thompson WB3FYP, 1014 Cable Ave., Pittsburgh PA 15238; 412-828-5966.*

HADDONFIELD NJ
SEP 18

The South Jersey Radio Association is holding their 40th SJRA Hamfest from 8 AM to 2 PM. Admission, $3; tailgating or table, $5. VEC testing, door prizes. Talk-in on 144.69/145.29. Contact *Alan Sherman WB2OEZ, Hamfest Chairman, 609-768-8380 or SJRA, PO Box 1026, Haddonfield NJ 08033.*

OLD WESTBURY NY
SEP 18

The LIMARC ARRL Long Island Hamfair will be at the NY Institute of Technology. Tailgating $5, admission $3. Non-hams and children free. Talk-in on 146.25/.85. Call *Mark Nadel NK2T, 516-796-2366.*

GOSHEN NY
SEP 24

The Orange County ARC is sponsoring its 3rd Hamfest. $2 at door, indoor tables $5 in advance or $6 at door; outdoor space $3 in advance or $4 at door. VEC testing. Talk-in on 146.760. Call *914-564-0688* or write *Barbara N2AWI, RD 2 Box 447, Wallkill NY 12589.*

SANTA FE NM
SEP 24

The Northern New Mexico ARC Hamfest will feature vendors, tailgate flea market, and programs for hams. Admission, $5. Children under 12, $3. Talk-in on 146.22/.82. Contact *Clem Burke W5IXR, Box 73, Ojo Sarco NM 87550.*

LAKE ISABELLA CA
SEP 24–25

The Bonnet Brigade, ladies' auxillary of Simi Settlers ARC, will operate WA6OHX 24/1500 UTC to 25/1900 UTC as part of their 1st annual Reunion Raid. HF freq. are: 14288, 7233, and 3888 kHz. The YL-only station will QSL contacts with specially designed cards. QSLs via *WA6OHX.*

ANTIOCH CA
SEP 24–25

The Delta ARC will operate KA6SIP to celebrate the Antioch Rivertown Jamboree. Frequencies: SSB, 7.260, 14.260, 21.360; 10 meter Novice 28.360; FM, 146.540/S; and packet 145.01. For commemorative QSL, send QSL and #10 env. to *Tom Deeble KA6SIP, 2224 Carmel Ct., Pittsburg CA 94565.*

73 AMATEUR RADIO®

International Edition

OCTOBER 1988
ISSUE #337
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A WGE Publication

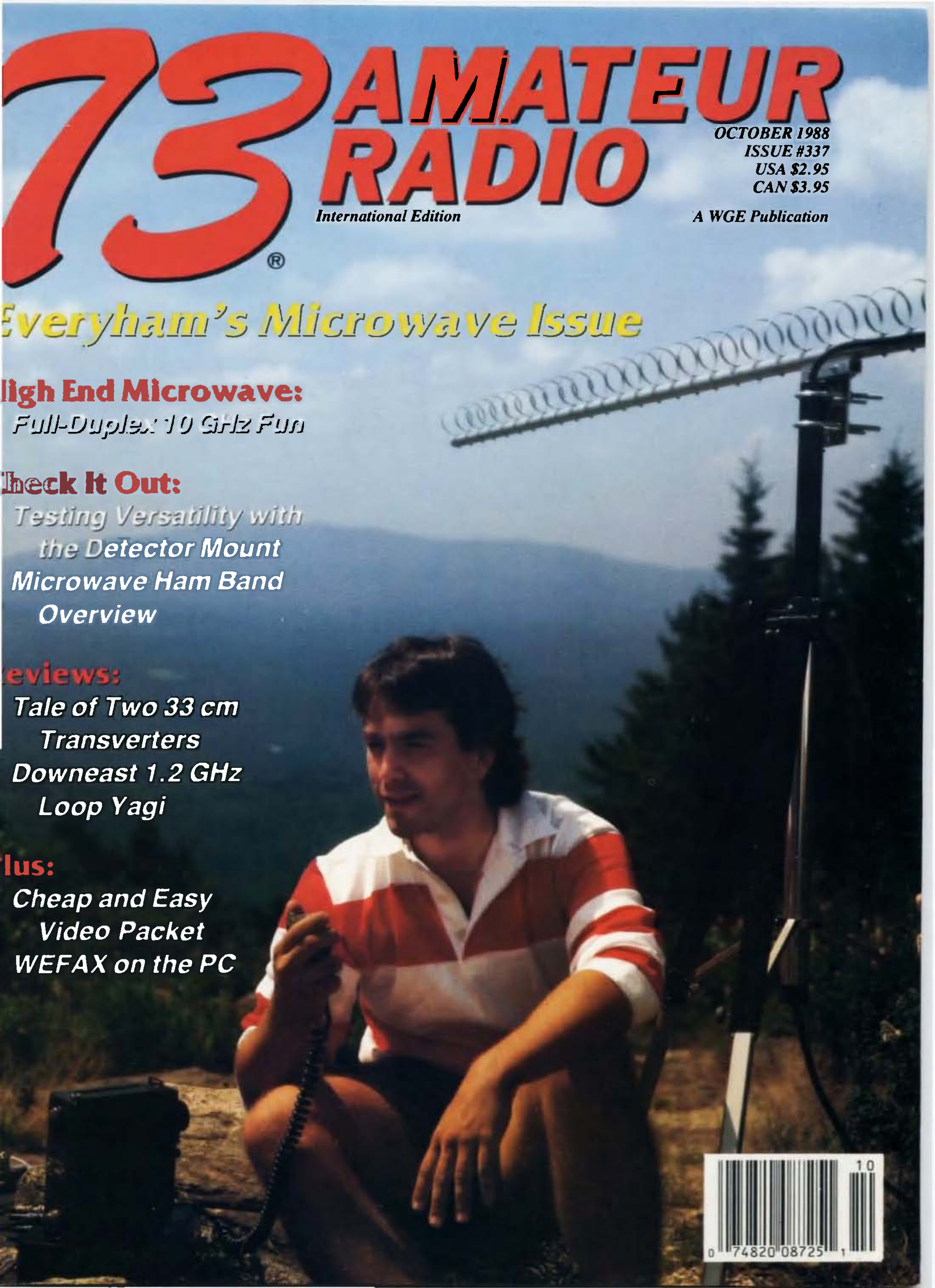
Everyham's Microwave Issue

High End Microwave:
Full-Duplex 10 GHz Fun

Check It Out:
Testing Versatility with the Detector Mount
Microwave Ham Band Overview

Reviews:
Tale of Two 33 cm Transverters
Downeast 1.2 GHz Loop Yagi

Plus:
Cheap and Easy Video Packet
WEFAX on the PC



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Welcome, Newcomers!

What's "Hot" About Microwaves

Microwaves first awed us (and made some of us very suspicious) with their ability to brew up a piping hot cup of coffee in 30 seconds, or cook a meal in 3 minutes. Now, we hear more about communications associated with microwaves. Telephone companies routinely use microwave relays, and many television studios transfer their programming to the broadcast site via microwave links. The proliferation of satellite dishes in residential back yards and on homes attest to the immense popularity of satellite TV, in which signals on the microwave bands are **uplinked** to, and **downlinked** from, satellites orbiting the equator.

Do the same waves both cook and carry communications?—most certainly! Furthermore, microwaves are part of the **electromagnetic wave spectrum**, which contains waves of immensely varying properties, such as X-rays, ultraviolet light, visible light, infra-red, and those that carry AM and FM broadcast signals, among others. The form of these waves, however, are exactly the same—they differ only in **frequency**.

More and more **hams** are taking an interest in microwave operation. Why this is just a recent phenomenon, and their vast potential, is the thrust of this month's column.

Long Known About

It's a little known fact that microwave communications has existed since the very early days of radio investigation. Guglielmo Marconi, the father of wireless radio, made his first major contribution to communications technology in 1897 by sending a microwave signal that was received several miles distant.[1] As early as 1933, a commercial microwave link was set up across the English channel, which operated for many years.

Why haven't hams, however, really ventured into these bands until recently? For a combination of reasons:

- Line-of-sight **propagation**. Except during highly unusual weather conditions, microwaves travel in a straight line. Waves of much lower frequencies, generally those below 30 **MHz**, usually travel to the ionosphere, which refracts them back to Earth to points many miles away.
- Specialized components. Only very precise (and expensive) components could cleanly generate such high frequencies.
- High **attenuation**. Microwave energy is much more absorbed by organic matter than waves of lower frequencies. Even moisture greatly absorbs microwave energy at certain frequencies in the higher end of the microwave subspectrum. It's this property that makes microwaves ideal for cooking!

Much has changed, however. Commercial interests have been developing microwave communication systems in earnest in the past 20 years, which has increased the supply, and driven down the cost, of microwave components. **Transponder**-equipped satellites for many communication services, including amateur radio, now orbit the Earth. They greatly increase the range of line-of-sight signals, and reduce the attenuation problem, since these signals do not encounter trees, mountains, and other energy-absorbing obstacles on their way to and from the satellite.

And what do these bands have in their favor? First and foremost is the vast amount of bandspace there is in the microwave region—one ham band alone contains almost as much bandspace as all the ham bands below it combined![2] This permits much **wideband** operation, which is desirable since, the wider the signal, the more quickly it can convey information. There are many **modes** of operation, too, that hams can investigate in the microwave regions, which can't be in the lower frequency regions due to the relatively narrow band allocations there. A secondary reason is that microwave antennas do not need to be as large as those needed for lower frequency signals, for comparable **gain**. These antennas, too, are easily made to be extremely directive, which helps reduce unnecessary interference.

Microwaves offer a unique opportunity for hams to explore new techniques and operation methods—and more cheaply than ever before. Come and explore this frontier! 73

de NS1B

[1] *Marconi's best-known contribution to radio communications is the first transoceanic wireless transmission. In December 1901, Marconi sent the letter "S" from a site near St. John's Newfoundland, which was received in Poldhu, Cornwall.*

[2] *The 3 cm (10–10.500 GHz) band is 500 MHz wide. All the amateur bands below 3 cm to 160 meters total up to less than 510 MHz of bandspace.*

GLOSSARY

Attenuation—Dampening, reduction.

Band—A group of frequencies.

Downlink—A signal that is sent from a satellite to an Earth-based station.

Electromagnetic wave spectrum—This represents the entire range of frequencies or wavelengths of electromagnetic energy. Radio waves typically range from 20,000 cycles/second to 300,000 million cycles/second. The microwave portion of the spectrum is typically set at 1,000–300,000 cycles/second.

Frequency—One of the two terms that characterizes electromagnetic waves. It is the number of cycles of a wave that passes a given point in a given period of time. (A wave cycle is the portion of the wave from ona peak to the next.) The frequency is usually given in meters per second, commonly termed **Hertz (Hz)**.

Gain—Describes the increase of voltage, current, or power. Gain is a ratio. A given transmitting antenna's gain, for example, is the strength of its radiated signals compared to the strength of the radiated signals of a reference antenna. Gain is usually represented in logarithmic units called **decibels** (dB).

Ham—Short for amateur radio operator.

MHz—Abbreviation for megahertz. This stands for "millions of cycles per second."

Mode—Mode has several meanings. In this case, it refers to the way information is imposed on a radio wave. AM and FM are two modes.

Propagation—This refers to the travelling of radio waves through a given medium, such as the atmosphere. The better the propagation, the further this energy travels through the medium.

Transponder—The unit on a satellite that receives a signal from Earth and simultaneously retransmits it back to Earth, on a frequency distant from the receive frequency.

Uplink—A signal that is sent from an Earth-based station to a communications satellite.

Wavelength—One of the two principal characterizations of an electromagnetic wave. The wavelength is conventionally measured from one wave peak to the next. This distance is usually given in meters or centimeters.

Wideband—Refers to a signal that occupies a relatively broad piece of spectrum. An AM broadcast signal, for example, takes up 6,000–8,000 cycles of bandspace, and so is not considered very wideband. The signal that carries the combined audio and color video to your TV set, however, occupies 6 *million* cycles of bandspace, making it wideband.

QRM

Editorial Offices
WGE Center
Peterborough NH 03458-1194
phone: 603-525-4201

Advertising Offices
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Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon acceptance. A premium will be paid for accepted articles that have been submitted electronically (CompuServe ppn 70310,775 or MCI Mail "WGEPUB") or on disk as an IBM-compatible ASCII file. All contributions should be directed to the *73* editorial offices. "How to Write for 73" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts.

Reprints: The first copy of an article—$3.00 (each additional copy—$1.50). Write to 73 Amateur Radio Magazine, WGE Center, Rt. 202 North, Peterborough, NH 03458. ATTN: Article Reprints.

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Contractual Agreement: By reading this far, you obviously have a discerning eye for detail. Good. Now we gotcha. Rules are rules, and the rules say you must promise to encourage growth of amateur radio with every breath for the rest of your life. That doesn't just mean new recruits. Don't forget to try a new mode or frequency band once a year. You MUST work at least ten Novices each month. Most of all, you will mention *73 Amateur Radio* with each identification you make on the air and also to every radio and electronics merchant you meet. You will also praise or damn each issue of the magazine with feedback cards or letters. That should be the easy part, especially with your eye for detail.

73 AMATEUR RADIO®

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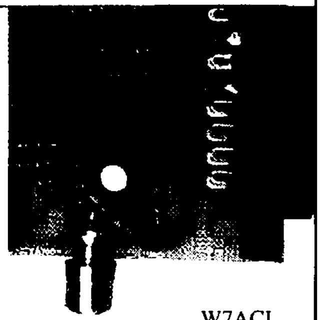
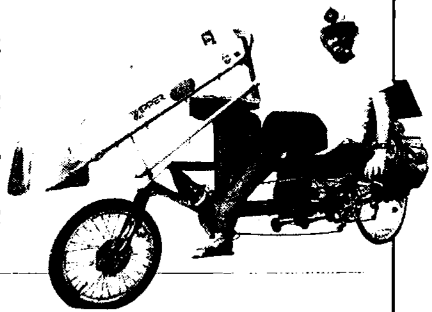
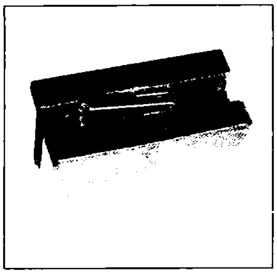




REVIEWS

DEPARTMENTS

**FEEDBACK...
FEEDBACK!**
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 81. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.



Cover model Jim Bail, *73* Ad Sales Representative and son of John Bail W8GFV who is Director, Receiver Division at American Electronic Laboratories. W8GFV directs microwave R and D for Military, Commercial, and Government applications. Jim is currently studying for his Novice ticket.
Photography by Suzanne Torsheya
Tower for September cover courtesy of Ken Nelson of Oakham, MA

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Ham Fun

If we're going to kick-start ham radio we're going to have to put more tun into it—particularly for the kids. One easy way is to get our clubs going again with hidden transmitter hunts.

Since this is virtually a lost art in America, we'll be starting a column on fox hunting in November. I hope we'll be able to build enthusiasm for the European style of fox hunting—mostly done on foot instead of driving around in cars. This is better geared to getting youngsters into action. The exercise will be good for you old duffers too. Work off some of that paunch.

The column will be written by Joe Moell KØOV, who co-authored the book, "Transmitter Hunting: Radio Direction Finding Simplified," the RDFer's bible.

Meanwhile, I'll be looking for articles from you on hiding transmitters, building miniature transmitters to hide, designing and building hand-held direction-finding antennas, and building small DF receivers. Don't let me down on this.

Of course there are practical RDF applications such as finding unidentified repeater pests and service net jammers, locating a stolen rig which suddenly appears on a repeater, finding TV cable leaks, finding line noise sources—things like that.

If we can make fox hunting as popular here as it is in Europe and Asia, we may eventually be able to field some teams for the international fox hunting contests in Europe.

Atlanta Was There—Where Were You?

A few years ago it looked as if the Atlanta hams might be able to give Dayton a run. It hasn't happened. It was going pretty well when Chaz Cone W4GKF was at the stick, building steam.

Two years ago they moved the hamfest into the World Convention Center, next to the Omni Hotel. Big place, but the parking is expensive and a long walk from the hamfest—too far to carry heavy ham gear, the hotel's expensive, and there are no nearby camping facilities. It's not easy to get stuff in and out of the indoor flea market.

The exhibits committee apparently gave so many booths to local club groups and non-ham exhibitors that they ran out of commercial ham equipment exhibit space. This limited the dealers and manufacturers exhibits to a pitiful few.

The talks were handled well, but were very sparsely attended. I only pulled about 25 or so for my two talks. They might have promoted them a bit better, but mostly it was the overall lack of attendance. The hamfest just wasn't supported by the local hams—much less those from neighboring states.

I missed the 1987 Hamfestival (I was visiting the USSR), but I was there for 1986 and it was very poorly attended. It was a bit better this year, but the hams from Georgia, Alabama and other nearby states were staying away by the thousands.

The few dealers who exhibited said their sales went well, with just about everything moving. Unlike 1986 and 1987, the few hams who did come brought money and spent it.

In the 70s, the Atlanta Hamfest was unique in that it regularly pulled bigger crowds on Sunday than Saturday. That's gone. Sunday was a wasteland, with many exhibitors pulling down their booths two or three hours before the show's official closing time.

As a known fooder, I was pleased to see a $5 buffet—rather good one, too. Plus they had free chow for the exhibitors, something guaranteed to put on a pound or two for me. Fortunately I got trapped at the *73* booth by a long-winded ham filling me in in-depth on his station equipment, so I missed the dessert—all gone by the time I got there!

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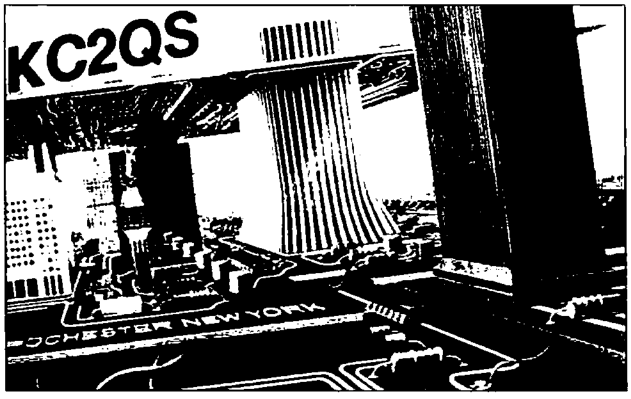

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Write On!

Want to earn some extra money and see your name in print, to boot? Due to the reader feedback we've been getting for the past year, *73 Magazine* will be running more reviews and light construction articles. To facilitate this shift, we need help from you, our faithful readership.

Builders generally don't try to write about what they build, mostly out of pen fright, but the plain fact is *anyone can write*. Ask for our writer's guidelines to see how easy it is. And don't worry if your prose isn't perfect—coherence is the main point. If your idea is good and reasonably explained, we will pay you top dollar for your piece.

How about an intriguing piece of ham gear on which you can't find a write-up anywhere? Perhaps *you* could be the first to tell the world about it! Send for our reviewer's form sheet.

73 Magazine is your forum. Don't keep your great ideas hidden in the shack—bring'em out for hamdom to read!

Joe Ham

Jack Speer N1BIC of Buckmaster, Inc. receives the monthly computer FCC data tapes of all licensed amateur radio operators. From the master file of all US licensed ham radio operators as of year end 1987, he determined the average age of US hams: 50 years.

Spread Spectrum

In an effort to pack more signals into a given piece of spectrum, engineers have traditionally looked for ways to minimize the bandwidth of radio signals. Imagine, however, a signal whose energy is *spread out* over a vast piece of spectrum—say, 500 MHz—so that the only effect it has on the ear is a slight raising of the noise floor. This is called *spread spectrum* (SS). Communications using this mode are possible when a transmitter and receiver follow identical FM schemes. Two SS signals occupying the same piece of spectrum, but using different modulation schemes, do not interfere with each other. Since the variety of possible waveforms and deviations (which compose a scheme) are nearly infinite, then it's possible to pack very many signals on the same piece of spectrum.

Many of you may be aware of the research going on with SS in the military and defense organizations, but few are aware that this is a legal mode for amateur radio! Those interested in finding out the latest in SS research for ham radio should contact the Amateur Radio Research and Development Corporation (AMRAD). Their address is PO Drawer 6148, McLean, VA 22106-6148.

You can also contact the AMRAD CBBS at (703) 734-1387. The system accepts 300, 1200, and 2400 baud, and the data path settings are 8 data bits, 1 stop bit, and no parity.

USSR Packet Radio?

On 28 June at 0324Z, Bill Slack NX2P worked UA3CR via packet radio on 14.105 MHz. Readers may recognize the Soviet call as none other than that of Leonid Labutin, whose interview appeared in the April issue under Ham Profiles. He is a foremost Soviet ham who coordinated communications for the Canada/USSR polar ski trek that took place earlier this year. Leo is also avidly interested in packet radio, but at the time of the interview indicated that packet radio was not then an accepted amateur mode in the USSR. This has apparently changed!

Packeteers who hear UA3CR and want to connect with him should bear in mind that Leo may have his transmit and received frequencies offset. Bill correctly guessed this after a half dozen retries, though signals were strong and the channel was clear. To effect the offset, simply move the frequency in small steps until you get a response to a connect request, and then adjust the RIT until you can decode the response.

Japan Ham News

Two bits of news from the Land of the Rising Sun:

—The JARL will soon begin work on another flight model of the JAS-1 with an eye toward launching a second amateur radio satellite, tentatively called JAS-1b.

—According to a report released by the Telecommunications Bureau of the Ministry of Posts and Telecommunications, as of 31 March 1988, they have issued a total of 1,608,128 amateur radio operator licenses. *The JARL News* did not indicate whether this figure represents all such licenses issued, or just current licenses.

More Able Cable

If the FCC has its way, you may get cable television delivered by the telephone company. The FCC says it may allow telephone companies to enter the cable television business in the same areas it allows phone service. The proposal may be just what's needed to get the telephone companies to install fiber optic wiring into residences, which currently costs a subscriber four times the amount over the installation of copper wiring. Fiber optic (lightwave) wiring of homes also allows phone companies to provide two-way services, pay per view TV, security, interactive video, and many other services not possible with copper wiring.

NIAC

Wayne Green W2NSD/1 has sent a letter to members of the amateur radio industry concerning the need for forming a National Industrial Advisory Committee (NIAC). The NIAC would act as a liaison between the amateur radio community and the FCC.

Green says that a previous NIAC was supported by the FCC, which provided a meeting room and support materials but "austerity programs finally doomed it." Wayne wants to revive it, saying: "We've let what was a hobby that provided virtually all the R & D for the communications industry *rot*. By allowing about 90% of the school radio clubs to die 25 years ago we've cut off the input of youngsters—the people who were doing most of the *inventing and* pioneering." He wants NIAC to research ways of attracting youngsters to ham radio. . . and to provide a voice with the FCC to help stave off a further loss of frequencies.

Wayne wants the NIAC to meet four times a year. The main annual meeting would take place in Washington DC, and the other three would take place at the three major hamfests—Orlando/winter, Dayton/spring, and Atlanta/summer. There would also be a monthly NIAC newsletter.

For more info on NIAC, contact Wayne at *73* HQ, at the address listed below.

Lithium Cell Warning

Do you realize that your (modern) HT may contain a miniature bomb? Lithium cells, used to maintain memory contents even when external power is removed, contain a volatile and toxic compound called thionyl chloride. Trying to force current back into these cells can result in a devastating explosion! Consider the case where a bus ticket dispensing machine was being repaired when the lithium battery's blocking diode failed. The resulting explosion injured five people who required hospital treatment for fume inhalation.

Big Thanks

. . . to the ***AMRAD Newsletter*, *JARL News*, the *ARRL Gateway*, *CQ Bars***, and ***W5YI Report*** for this month's out-of-house news. Keep your news items and photos rolling in to *73 Magazine*, 70 Rt 202 N, Peterborough, NH 03458-1194, Attn: QRX.

Packets Full of Pixels

Packet Scan Amateur Television

by Robert G. Pratt WD8AQX

My many hobbies include amateur radio, computers, and video. I recently discovered a way to combine all three into a fun-filled "super hobby" that results in very-slow-scan television images sent across town or around the world via packet radio.

Packet radio can be used for almost every type of communication, from simple messages and QSOs, to sending computer programs and data files. Once a computer file exists, it is simple to transfer its contents to another station over a packet radio connection.

My first experiments in what I call "Packet Scan Television" (PSTV) took place in early May 1988, shortly after an exciting trip to the Dayton HamVention. One of the things that attracted my attention while nosing around Hara Arena in Dayton early that Saturday morning, was a display by Kinney Software.[1] They developed a computer program and a small video digitizer circuit that could be plugged into the user port of a Commodore 64 computer.[2]

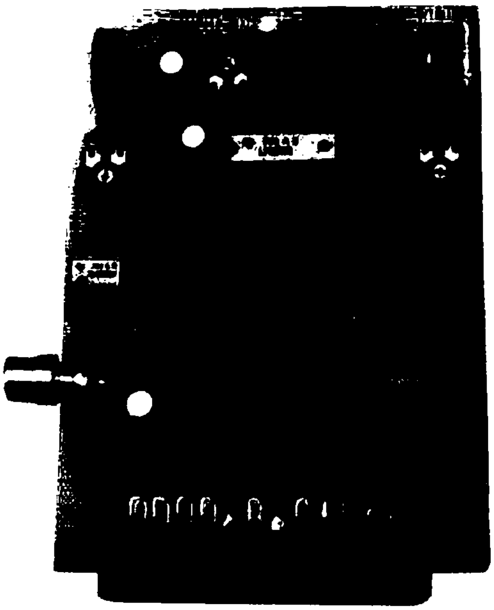

Photo A. Kinney video digitizing circuit.

Their system is designed to take a video signal from a camera or VCR, and convert it into a digitized bit pattern that the computer can display on its screen and store in a disk file. The electronic circuit is a synchronized video sampler which operates under control of the computer. Each horizontal line of the incoming video signal is sampled at a certain point and a pixel (picture element) is collected and digitized. When each line of the incoming picture has been sampled at the same point, a column of digitized video information has been obtained. This is stored in the computer's memory.

The timing is advanced, then a new column is sampled slightly to the right of the previous column. When added to the computer's memory, a new, wider column of video information is created. When the entire width of the incoming picture has been sampled, the computer contains an 8K byte file which fully describes the picture in digital format.

To get you started on this project, Kinney Software offers an etched circuit board, full documentation, and the software to perform these amazing video tricks. The sale price at Dayton was a paltry $35, and I couldn't resist what looked like a bargain. As it turns out, my purchase of their Video Digitizer was a good investment.

On my return home, an extra $20 at Radio Shack provided all the necessary electronic parts. For those less inclined to go shopping, or those who have only a meager spare parts box in the basement, parts kit KVD #01 can by purchased from Midwest Surplus Electronics, PO Box 607, Fairborn, Ohio 45324. The price is $19.95 plus $2.00 shipping and handling.

The Kinney Circuit

This circuit consists of four integrated circuits, four transistors, several capacitors, a handful of resistors, five pots, and a couple of connectors (see Photo A). It took longer to buy the parts than to install them. In a couple of short evenings, it was all together and ready for the smoke test.

One of the nice things about this little gem of a circuit is that it actually worked when I first turned it on. There was no troubleshooting, weeping, or gnashing of teeth. Well, I have simplified it a bit to spare you some of the details. I DID have to adjust the pots. It took about five minutes and was done "by guess and by gosh," with a little help from the Kinney instruction sheet.

Is That Me?

I had set up my video camera in anticipation of the circuit working, but when the screen initially sprang to life under control of the software, there was nothing but a big white square. I studied it carefully, wondering what to do.

I cranked the brightness pot on the circuit board down to ¼ scale, and a black and white scene appeared, showing equipment on shelves and the rear view of a fellow hunching over a computer keyboard. It must be some image they put on the demonstration disk, I thought, although the scene looked vaguely familiar. I leaned back to reconsider.

A few seconds later, the fellow on my screen was now also leaning back in his chair. I'm not always quick to grasp a new concept, but when this one finally sunk in, I let out a shout that the neighbors are still talking about. From that great beginning, everything has continued to go well.

The circuit and software capture a new picture from your camera or VCR over a period of about three seconds. Each sample is digitized by the computer and stored in a bit-map memory. The software (Photo B) allows you to select the gray scale from 2 (black and white) to 8 (six shades of gray between black and white). You can "pseudocolor" the images by substituting other colors for the gray shades. You can also command the computer to save the pictures (black and white only) to the disk and recall them for later viewing.

The on-screen menu (Photo C) also provides for picture storage in formats compatible with other graphics software, such as Print Shop, Newsroom, Koala, and Doodle. This latter feature is a real bonus because it allows you to print the captured pictures on a conventional printer, or use them in newsletter articles. I've tried two of these already and found that Print Shop does a nice job. Newsroom picture printouts, however, appear somewhat coarse and lacking in detail.

A nice feature of the Print Shop program[3] is that the user can add text to the video image

by using some of the commands in Print Shop's Screen Magic section. I tried this by taking a picture of me in my ham shack, facing the camera this time to show my better side (Photo D), then adding my call letters to the lower left corner. It worked fine, and when saved to disk, produced a file that could be read back into the Video Digitizer program for "slide-show" type displays.

The Inspiration

I was chuckling about my great success with this project when another idea hit me. Since I can store the picture in an 8K disk file, why not transfer the file over packet radio to someone else so he can view the picture on his screen, or commit it to posterity on his printer?

Gerry Gomes (WB8RNY) lives about 25 miles south of me, has the same computer I have, the same Kinney and Print Shop software, and a great experimenter's mentality. Gerry and I have whiled away many hours on the Edison UHF repeater while hunched over our computers, desperately trying to untangle the mysteries of wayward electrons.

Photo B. Kinney Software gray-scale selection menu.

I called Gerry on the repeater, and he was as intrigued as I was about trying to send my first picture file. It took several minutes to make the packet transfer on 2 meters, then I waited while Gerry loaded the Kinney software.

"What will the picture show?" he wanted to know. "Not a fair question," I said. The real test would be to see if he could figure out what it was.

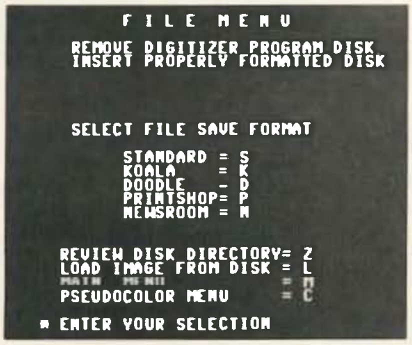

Photo C. Kinney Software onscreen menu. This provides for picture storage in formats compatible with other graphics software.

Photos D, E Photograph of WD8AQX in his shack. . .and the same image received by Gerry WB8RNY 25 miles away via 2-meter packet video.

The world's longest two minutes passed, then the repeater burst to life again. "Wow, it's your ham shack and you're sitting right in the middle of it!" he shouted. The picture (Photo E) was not as clear as a regular television image because of the lower resolution of the digitizing process, but Gerry was able to describe some of the equipment in my shack, and tell that I had a silly smirk on my face. Not bad for our first shot at "Packet Scan Television."

Gerry then loaded the Print Shop program on his C-64, entered the picture file I had just transmitted to him, and printed a copy of my picture on paper. Although not quite as sharp as the video display, the paper allows you to permanently save a hard copy of the image for decorating a wall or using in a newsletter.

Gerry had not yet built the Kinney circuit when this first great experiment took place, so he was not able to digitize an original picture from his camera. The Kinney disk contains some demonstration pictures, however, and he decided to take one of these, modify it using the Print Shop Screen Magic program, and send the picture back to me so we could claim a two-way video exchange.

A few minutes later my packet TNC sprang to life with a connect from WB8RNY and the picture was on its way. While waiting for the transfer to finish, I grabbed the mike on my UHF rig and made the same mistake Gerry had made earlier. "What will I see?" I asked. "You tell me," he said.

When the transfer was complete, I saved his file to disk, loaded the Kinney "Video"

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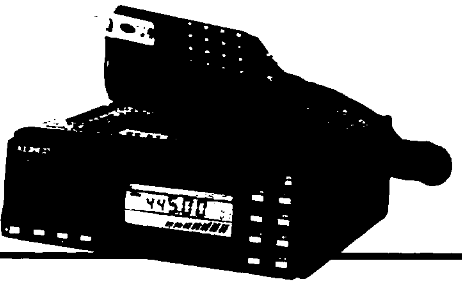
73 Review

by Jennifer Roe WA6OHX

Alinco 24T 144/440 MHz FM Transceiver

This little rig gets an A+



Alinco Electronics Inc.
20705 South Western Ave., Suite 104
Torrance, CA 90501
(213) 618-8616
Price: $637.95

Most hams shopping for a new mobile FM rig have at least narrowed down the choice offerings from the Big Three manufacturers. I'm here to offer some simple advice to those folks: Wake up! Take a close look at Alinco's 24T. This is one of the nicest, easiest-to-use rigs in its class, and for a very reasonable price.

This little black beauty offers virtually every feature an FMer could desire in a 2½ pound package. Besides two VFOs, 21 memories, and 25 watts on both bands, the 24T boasts a DTMF encoder, subaudible tone encoding and decoding, a built-in duplexer, programmable offset frequency, priority channel designation, and scanning (140–150/440–449.995 MHz). The 5½" by 2" by 6½" package will mount almost anywhere in today's cramped car interiors.

First impressions can make or break a friendship. The 24T's cheerful, informative, light green LCD and simple control layout do not intimidate the new user, unlike so many rigs these days. Every function is clearly labeled, and most are self-explanatory. Three switches atop the unit select scan resumption delay (0 or 4 seconds), scanning speed (4 channels per second or 20 channels per second), and beep on/off. When turned on, the beep reminds the user of frequency changes, especially useful when he or she can't devote any eye time to the rig. A reset switch next to the switches clears all memory and returns the CPU to its factory-programmed state.

Masters of the obvious will, no doubt, wonder at the mic connector missing from the front panel. Not to worry! The rear panel sports a 6" cable with an 8-pin male mic connector, to which the microphone attaches. Similarly, a female UHF connector dangles from another short, rear-mounted cable. Why take up precious front and rear panel space with big connectors? The main advantage of this arrangement seems to be installation flexibility and neatness. No more need for UHF elbow adapters, crimped coax, or panels obscured by cables run amok.

Further, easy access to the antenna connector, the quick-disconnect power cable, and a snap-in mobile mount, cut radio installation and removal time to just a few seconds. In ten seconds or less the radio can be out of sight, secure from prying eyes and fingers at shopping malls or darkened urban streets. The safest radio is one that isn't there to steal.

Travellers or those who change vehicles frequently will like the 24T's small size, light weight, and ease of installation. Solder a cigarette lighter plug to the power cord, throw a small mag-mount antenna into a suitcase, and voila! A complete VHF/UHF station ready for action anywhere.

The rig's 25 watts on both bands let it reach out and touch just about any repeater worth bringing up, and it gives plenty of margin for long-distance simplex operations. With a Bird 4381 power meter and a 50Ω load, I measured 23.5–26.5 and 22–25 watts output on the 144 and 440 MHz bands, respectively. Low power measurements, 6–8W and 5.3–6W, ran slightly higher than the specified 5 watts. The unit draws about 300 mA in the receive mode and just over 5A while transmitting at high power.

Initial set up and operation is straightforward. Turn the power on with the ON/OFF/VOLUME knob, adjust the squelch setting with the concentric ring, and tune to the appropriate frequency with the larger, main tuning knob on the far left of the front panel. The UP/DOWN tune buttons on the hand mic also change frequency. Two small buttons underneath the main tuning knob change the frequency up or down in one megahertz increments. Another small button selects high or low power, and the fourth button in this panel position initiates scanning. Seven of the eight buttons on the rig's right front panel are dual-function. Alternate functions are selected by first pressing the F button, then pressing the correct funtion key.

For repeater operation, the +/− offset key alternatively toggles between −, +, and simplex. Unusual offsets can be programmed simply by hitting F, OW (offset write), and by using the tuning knob to select the correct offset. The user can select 5, 10, 15, 20, or 25 kHz tuning steps in a similar way after hitting F, TS (tuning step).

Storing frequencies in the 21 memories is as easy as one, two, three. The MR key cuts the mode to memory recall. Use the MHz tuning keys to select a memory. Tune the appropriate frequency into VFO A or B, and hit the MW (memory write) key. Memories 1 and 2 contain "call channels," which are frequently used channels you will want to be able to recall quickly with one or two keystrokes (CALL 1, or F, CALL 2). Memories 20 and 21 store lower and upper scan limits, respectively. Scanning in memory recall mode will initiate stepping through all 21 memories. The memories store all programmed information, including offset, subaudible tone selection, and priority channel designation. (The 24T samples the priority channel one second out of every six seconds.)

No options to buy here, either. The 24T includes both a subaudible tone decoder and encoder. The decoder functions as a "tone squelch"; that is, the squelch will not break until the appropriate tone is received. Of course, the encoder transmits a subaudible tone for other transceivers or repeaters employing tone squelches. One of the 37 CTCSS tones are selected by hitting TONE and selecting ENCODE, DECODE, both followed by F, TONE NO. and tuning in the right tone with the main tuning knob.

The 24T features a built-in duplexer. With a single dual-band antenna, the rig can operate in a crossband, full duplex mode. (Use of two antennas requires an external duplexer.) Loading the separate transmit and receive frequencies in the two VFOs and pressing F, DUAL enables this mode. This is also handy for programming non-standard offsets not viable with the OW function.

The Alinco 24T's electret condenser mic sounds pretty darned good on transmit, and its 2 watts of audio power is more than adequate for noisy road conditions. The speaker is on the bottom, suitable for most installations. Those not satisfied with the rig's internal speaker can always plug an 8Ω external speaker into the jack in back.

Packeteers should rejoice to find adequate audio qualities and performance for their favorite mode. On the down side, Alinco does NOT provide audio on the mic connector. However, pin 6 is left free for what should be a relatively easy modification to correct this deficiency.

This rig is, in a word, HOT. It looks and sounds good. There are no nasty surprises like three-handed control combinations. There are NO options to purchase for full-featured operation. Above all, the price is fantastic.

A Trip Through The Microwave Spectrum

Up, Up, and Away . . . . to 10 GHz!

by Pete Putman KT2B

Let's try something fun for a moment. Grab a ruler, or a tape measure if it's handy. Got it? Pick up a pencil and draw a line 5" long. Now use the ruler to divide it in half, just over 2½". Finally, divide that line in half to 1¾".

You have just sketched the dimensions of a quarter-wave antenna for the 13 centimeter band—2.3 GHz, which is 2300 MHz, or 2,300,000,000 Hz. (That's a LOT of Hertz!) Pretty small, isn't it?

The thrust of this introduction to the amateur microwave bands is think small. On the other hand, we can also think BIG while we think small, and I'll show you what I mean as we move on.

Overview

The majority of amateurs are active on the HF (High Frequency) bands—that is, 160 through 10 meters. These are the first frequencies on which most operators get up and running. A considerable number of hams venture higher, to 6 meters, 2 meters, 1.25 meters, and even 70 centimeters, which is as high as most of them will ever go.

But to think that life ends after 450 MHz is grossly in error. The biggest chunk of spectrum allocated to the Amateur Radio Service lies above 900 MHz, where one band alone (23 centimeters) is larger than the combined bandwidth of all allocations from 160 meters through 220 MHz! That's a lot of room to play with, and the room is largely empty most of the time.

For whatever reason, the bands above 900 MHz are underused by most amateurs. Could it be ignorance? Reluctance to spend money? Little or no understanding of propagation at these frequencies? Probably a combination of all three! Well, grab your hats and come aboard for a short flight over the "Uncharted Territories" as we unravel some of the mysteries of microwaves!

The 902 MHz (33 Centimeter) Band

Compared to its higher-frequency cousins, 33 cm is just coming into adolescense. Yet it's a "hot" band of late, with a preponderance of schematics for preamps, converters, transverters, and amplifiers showing up in numerous publications. The allocation is actually from 902 to 928 MHz, but for the moment most activity is taking place near the low end of the band, between 902 and 904 MHz.

> *". . . (23 centimeters) is larger than the combined bandwidth of all allocations from 160 meters through 220 MHz!"*

A half-wavelength at 33 cm is roughly 6½" long, making designs of high-gain antenna arrays quite simple. Two popular yagis are (1) Conventional half-wave element types and (2) Full-wave loop designs. As I mentioned earlier, thinking "small" allows us to think "big," which translates into multi-wavelength booms for higher forward gain and fairly narrow beamwidths.

Since 33 cm lies just above the cellular telephone frequencies, much surplus cellular equipment has been modified (or stripped for parts) and incorporated into amateur stations. Many semiconductors developed for cellular operation are easily obtained at a reasonable price, and a number of designs based on commercial power modules have sprung up in amateur microwave newsletters.

At the moment, there are no manufacturers in the USA or Japan with a line of amateur transceivers for this band. There is a mobile citizen's radio service in Japan which uses low-power FM equipment in the 900 MHz range, and perhaps some of these units will make their way across the Pacific. Currently, only SSB Electronics of West Germany, and LMW Electronics of England, manufacture linear transverters for 33 cm. Both models accept all modes (except ATV) and run about 20 and 6 watts output respectively, using a 144 MHz IF. For ATV buffs, PC Electronics of California sells a 33 cm transmitter with the capacity for audio subcarrier.

Propagation at 902 MHz closely resembles that found on the 23 cm band (1240-1300 MHz). Radio waves at this frequency propagate line-of-sight and are largely limited by atmospheric attenuation. Obstacles such as densely foliated trees, large buildings and hilly terrain, can become formidable obstacles to the average 33 cm signal! The quantity of precipitation in the air can also degrade communications.

For the average home station running 5-10 watts to a single loop/dipole yagi, communications from 25 to 50 miles can easily be reached with smooth terrain. The fun begins when atmospheric conditions form temperature inversions, layers of cooler air trapped between layers of warmer air. This phenomenon creates something approximating a "duct" (such as that in air conditioning), and 33 cm signals entering the duct may come from hundreds of miles away.

Such paths have occurred from the central states to the northeast, across the Gulf of Mexico, along the Atlantic coast, and even from Hawaii to southern California. While the path from Hawaii to Los Angeles has been worked on all bands from 144 through 1296 via tropo, it remains to be done on 33 cm. As of this writing (7/10/88), the record for a 902 MHz contact is 623 miles, between Texas and Florida.

The 1240-1300 MHz (23 Centimeter) Band

Of all the bands above 900 MHz, 23 cm is probably the most accessible at present. It's a worldwide allocation (unlike 33 cm), and many transverters, transceivers, antennas, preamps, and amplifiers are available for it. For those inclined to homebrew, circuits

abound to help the ham get up and running in a hurry.

23 cm has been in the allocation tables for quite a while, and a detailed band plan exists supporting a variety of modes, including packet, SSB/CW, ATV, and satellite operation. A half-wavelength at 23 cm is about 4½", making the design of high-gain yagis quite easy. Many 23 cm designs have been scaled down to 33 cm with excellent results, and solid-state amplifier designs for 23 cm have also been used this way.

23 cm is also part of the Enhanced Novice allocation, and this, coupled with the popularity of the band overseas, has led to a major commitment by the large manufacturers to 23 cm transceivers. Kenwood, ICOM, and Yaesu all manufacture FM handhelds and mobile radios for 23 cm, while ICOM and Yaesu also make multi-mode base station transceivers. On the transverter side, SSB, LMW, and Microwave Modules all make high-performance equipment. SSB and Down East Microwave sell a full line of solid-state "bricks" (amplifiers). Antennas are available from KLM, Tonna, Larsen, J-Beam, and Down East. PC Electronics also makes a nice 23 cm ATV unit.

Moonbounce (EME) operation is quite popular on 23 cm, partly because a high-gain array of yagis (or even a dish) doesn't take up much room. Many weak-signal operators around 1296 MHz are running some truly monster arrays. How about four 55-element yagis on an H-frame? (Imagine running 220 elements on 2 meters!) Propagation is very similar to 33 cm, with everyday communications possible over a 25-50 mile path on smooth terrain.

Tropospheric enhancement can produce spectacular results on 23 cm. During the June 1988 VHF Contest, daytime SSB/CW contacts from the eastern shore of Virginia to New York City, Long Island, and South Jersey, produced signal levels in the S-1 to S-3 range. However, at about 9 PM, the same signals were literally 60 dB over S-9 due to tropospheric enhancement. The reason? The ocean cools off faster at night than the shore areas, and tropo "ducts" were formed.

From late summer through late fall, tropo enhancement can often occur many miles inland. A tremendous opening in late November 1986 resulted in hundreds of 1296 contacts between stations in New York, Pennsylvania, and Ohio, and stations in Texas, Oklahoma, and Kansas. In many cases, both sides were running under 10 watts output to modest antennas . . . . . testimony to the power of a tropo opening!

The 2300-2450 MHz (13 Centimeter) Band

13 cm has been coming into its own lately, with a general upswing of interest along the East Coast, central Midwest, and Southern California. A half-wavelength at 13 cm is just 2.5", making the construction of a conventional dipole-element yagi somewhat difficult. Here is a band in which dish antennas start to look more attractive, but the ever-present loop yagis are quite practical as well.

All modes are permitted on 13 cm, but the most popular are SSB and CW weak-signal work. 13 cm is also used for remote FM links and control lines in areas where high mountains offer line-of-sight paths to urban areas, and telephone lines would be impractical. Satellite operation is now available with the addition of a 13 cm downlink from Phase 3C, using a beacon at 2400.325 MHz and a Mode "S" uplink/downlink from 435.600 to 2400.700 MHz.

13 cm tends to be an experimenter's band due to the lack of commercially-manufactured amateur equipment. Only two companies make transverters for this band—again, SSB Electronics and LMW Electronics. Another stumbling block for potential builders is the lack of linear solid-state devices for power levels over 1 watt. Most designs adapted from commercial or military devices rely on 26-volt supplies and grounded-base bipolar transistors. As such, they run Class C only, but this is not a problem when operating CW.

The limitations of low power are more than made up by larger antenna arrays, such as 4 to 10 foot dishes or multiple-bay loop yagis. A fly in the ointment is the considerable losses incurred in conventional transmission lines at this frequency, as the dielectric tends to absorb RF energy. Most serious 13 cm operators use ⅞" hardline, and even it has moderate losses at this frequency.

Despite the drawbacks, propagation at 2300 MHz can be extensive. A modest station running 1-2 watts to a 20 dB antenna should be able to work about a 10 to 15 mile radius from the home station. Longer paths can be worked during periods of enhancement, and a well-equipped station running 50 to 100 watts to a 20-23 dB array might be able to work over 200-300 miles if conditions are right.

Precipitation poses a major hurdle, as large raindrops or snowflakes tend to reflect or refract the signal away from its intended recipient. Indeed, many 13 cm operators work each other along partially-obstructed paths, taking advantage of consistent refraction by nearby hills or buildings. Stations have even worked via "airplane scatter" where the signals have used a 747 passing overhead as a reflector. This technique has also been tried on 23 cm.

The 3300-3500 MHz (9 cm), 5650-5925 MHz (6 cm), and 10000-10500 MHz (3 cm) Bands

Here is some truly uncharted territory. Talk about available spectrum space! The 3 cm band alone is bigger than ALL amateur allocations through 13 cm. These are truly the "millimeter-wave" bands, with a full wavelength at 10,000 MHz (or 10 GHz) measuring just over 1 inch. As might be expected, construction of conventional yagis would be all but impossible here, so waveguide and feedhorns are the preferred method of transmission, either directly or to illuminate a dish.

Virtually anything can send a signal from these bands astray: A bird flying in front of a dish, tall buildings, vehicles, dense rainclouds or foliage. These are literally "line-of-sight" frequencies. Power generation at these frequencies is not an easy task. Most stations are typically running under 1 watt, often at less than one-tenth of 1 watt.

Two modes predominate here: Wideband FM, employing Gunnplexers or similar Gunn diode oscillators, and narrowband CW/SSB, using transmit/receive converters with intermediate frequencies at 144 MHz. Virtually all of the equipment used on 9 cm and 5 cm is homebrewed, while there are at least two commercial units on 3 cm, the SSB Electronics Microline Transverter, with about 100 mW output, and the previously-mentioned Gunnplexers, with 10 to 20 mW output.

Signals can also be enhanced by tropospheric effects (although to a far lesser degree than on 903 and 1296). The record for a 2-way 10 GHz path was set from the coast of Spain to an island in the Mediterranean Sea—a path entirely over water. In this case, the ducting was used as an extended waveguide to get more mileage out of the milliwatt signal levels.

Summary

The frequencies from 900-10000 MHz represent a vast resource that lies largely untapped by all but a small percentage of amateurs, yet nowhere else in the spectrum do we have the space to run virtually all modes with little or no QRM, and minimal interference from inclement weather. Although high power levels are harder to obtain, higher gain antennas more than compensate.

This "trip" has been by no means conclusive! I have purposefully neglected the bands above 10 GHz due to the limited scope of this article. If you are stimulated to try operation on one or more of these bands, I suggest you obtain copies of the following publications: (1) *The ARRL Handbook*, 1988 Edition, (2) *The VHF/UHF Manual*, by G.R. Jessop, (3) *The Proceedings of the 1987 Central States VHF Society Conference*, (4) *The Proceedings of Microwave Update '87*, and (5) *Proceedings of the Mid-Atlantic VHF/UHF Conference*. All are available from the ARRL Publications Dept.

You may wish also to subscribe to any of the numerous regional newsletters that detail UHF and microwave operation. Three good choices would be the *Midwest VHF Report*, published by Roger Cox WB0DGF, 3451 Dudley St, Lincoln NE 68503: *VHF/UHF and Above*, published by Rusty Landes KA0HPK, PO Box 126, St. Mary of the Woods, IN 47876; and *Feedpoint*, published by the North Texas Microwave Society, c/o Wes Atchinson WA5TKU, Rt. 4, Box 565, Sanger TX 76266. Another newsletter, which has some excellent circuit ideas from time to time, is *Cheese Bits*, published by the Mt. Airy VHF Radio Club, c/o Harry Stein W3CL, 2087 Parkdale Ave, Glenside PA 19038.

Number 7 on your Feedback card

10 GHz Polaplexer Transceiver

A unique system for full duplex operation on the 3 cm band.

by C.L. Houghton WB6IGP

The construction of the polaplexer transceiver was prompted by W6OYJ and others who needed circulators for their own projects. A very simple 10 GHz transceiver could be built but required a circulator, a hard-to-find and expensive component. The point we were trying to accomplish was an inexpensive alternative that could provide excellent performance and an easy construction project. This approach goes back 30 to 40 years and involves many amateur's efforts, including W6IFE and W6VIX. Ed W6OYJ's design is quite simple and uses only one out-of-the-ordinary component—a Teflon™ rod.

Required Components

The shopping (junkbox) list includes a Gunn diode, a short section of WG-16 waveguide, brass shim, 1/16" brass rod, and a 1" piece of Teflon™ rod. Those with their own Gunn oscillator will not need the Gunn diode. I used a Solfan intrusion alarm Gunn oscillator that I found at a burglar alarm company. The power output of this unit normally is 5 to 10 mW. After substituting a higher power Gunn diode, however, the unit now produces 100 mW output. I was able to obtain a large quantity of high power Gunn diodes for 6, 10, and 18 GHz operation. You can easily find the remaining pieces in most local well-stocked hardware stores or at the local swap meets and surplus dealers. The high power Gunn diodes I have made are available for amateur radio construction. I will make a kit of these components available to those not able to locate them.

Easy Design

The design of the polaplexer is very simple. It uses standard plumbing brass tube found in a bathroom water closet as an overfill pipe. The cost of these pipes is about $2.50 in most hardware stores. One end of the tube is fitted with a waveguide flange, that is turned out on its center to fit the outer diameter of the 1" brass pipe. Through this flange is where the Gunn oscillator attaches. This can take several forms, including the familiar intrusion alarm microwave units or a homebrew Gunn oscillator made out of a piece of WG-16 waveguide. In either case, the oscillator is coupled through a Teflon™ transformer which is positioned just inside the mounting flange on the inside of the 1" brass tube.

The Gunn oscillator serves both as the transmitter and injection oscillator for the detector mount. The transmitter is frequency modulated by varying the power supply voltage. On receive, a small portion of the oscillator power is coupled into the detector. The difference frequency, 30 MHz in this case, is detected by the mixer diode and amplified by the following IF stage. The sensitivity of this polaplexer is quite competitive with a good circulator and performs quite well. It is especially good when used with a quality low-noise detector diode. I use a Microwave Associates (M/A COMM) 1N23WG with a maximum noise figure of 6.5 dB.

Approximately 30 dB of isolation between transmit and receive is achieved due to cross polarization in the circular waveguide. When using a polaplexer, offset the unit 45 degrees from true when working vertical Gunn units. The convention is to rotate the receive off vertical towards the right when facing the distant station. When operation is with other circular units, no offset adjustment is necessary. See the system photographs and Figure 1 for details. Add to this package a simple regulated power supply of about 10 volts DC with an IF amplifier operating at 30 MHz for the detector IF output and you are nearly ready to put this system into operation.

Making The Flange

The heart of the system is a 5 13/64" section of brass tubing. I first mounted the tube into a flange that was prepared by opening the 1 by ½" normal rectangular to a full circular to accept the 1" brass tube's OD in a slightly tight fit. I used a lathe to cut open the waveguide flange, and fashioned a square piece of brass plate with a center cut hole to fit the 1" tube.

After assembly, polish the finished flange

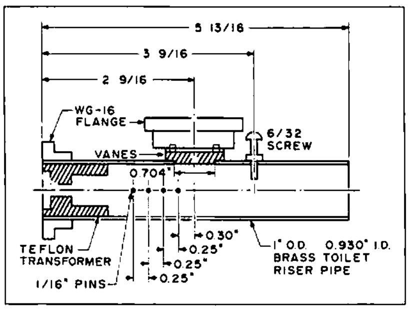


Figure 1. Cut-away profile of the circular waveguide, with the Teflon™ piece inserted.

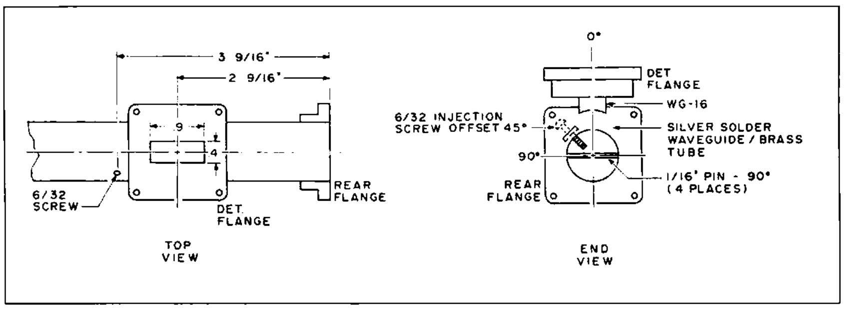


Figure 2. Two views of the circular waveguide. The left diagram shows the top view, with the square figure in the center as the detection flange. The right diagram shows the end view.

and joint end surface on a flat surface with a fine piece of 400 grit sandpaper to make the flange's fit tight and uniform. Place the paper on a small piece of glass scrap to maintain the flat surface when polishing. For home-brewing flanges, I suggest using 3/16- to 1/4"-thick brass plate. After checking for good fit, remove the rear flange for attachment.

I then removed a short section of waveguide with the flange attached to serve as the detector mount. This section of waveguide need be only about ¼" long, extending out of the back of the flange. Cut one off from some scrap piece of waveguide with the flange attached. File the end of the waveguide to fit the curvature of the outside of the brass tube, taking care to align the waveguide length parallel to the tube length. Mount the flange centered 2 9/16" (2.5625") from the end of the brass tube. The center measurement is from the inside of the waveguide. See Figure 2 for placement of the detector flange on the brass tube.

Detector Construction

With hard silver, solder the short piece of waveguide to the side of the brass tube. Make sure to remove any solder that flowed inside, so the inner surface is a smooth transition from brass tube to waveguide—excess solder is quite messy. The primary reason for using hard silver solder is so it will stay intact when other parts are soft-soldered to the polaplexer. Don't ruin a careful and time-consuming alignment with quick construction methods and soft solder! Also, place moist paper towel into parts of the soft-soldered to keep excessive heat from desoldering them.

Verify the alignment of the half-finished assembled polaplexer after the silver soldering operation. If in good order, remove the brass tube inside the waveguide fitting by drilling some of the center material away. Fine-file to keep from scoring the waveguide itself. Caution: Do not remove the small edge lip of the brass tube as it extends into the inside of the flange for 0.150" on either side of the inside of the waveguide fitting, 0.9" length side of waveguide. See Figure 3 and 4, inside of waveguide detail.

Detector Vanes

Now prepare the brass vanes for insertion into the waveguide opening. The space is an equal distance across the width of the detector coupling. Fit them with a section of brass on the top section, approximately 0.4" by 0.1". All parts are made from brass shim stock about 0.010" thick. I prepared the parts by cutting all components and trimming them to fit. I then made a jig, with small pieces of wood scraps, to hold the two vanes in position while I silver soldered the two top pieces together. I soldered the top of the vanes to the bottom of the top plate (0.4 by 0.1") using a small amount of silver solder to tack the pieces together.

Once the vanes were fitted in, I cleaned up the part by removing excess solder, and begin fitting it inside the flange for good fit. It requires patience, since it will more likely move the vane part during soldering. File to fit the scale shown in Figures 3 and 4. The vanes are soft-soldered into the waveguide for a final fit. After all other operations are completed, set them aside for the time being.

Detector Pins

See Figures 1 and 2. Four holes are now drilled into the brass tube. The first hole is located 0.30" back towards the end of the tube from the center of the attached waveguide detector mounting flange. This hole point is centered on the brass tube and is perpendicular to the axis of the detector flange. Make sure the drill press does not wander and that the hole drilled is centered and uniform on both sides of the tube. I used a 1/16" bit in my drill press and a short section of angle bracket to hold the brass tube in a bench vise while drilling.

I used a small guide drill about 0.030" to ensure that the holes are centered where I want them. It is not necessary to drill through the material—it just provides a guide. I avoided center-punching for fear of scoring the material.

The other three holes are 0.25" center-to-center apart from the first pin. I tapped the pin in with mild force as the brass rods were a tight fit. I suggest cutting off the excess with wire cutters, since bending to hold in place distorts the inside position. Soft-solder both sides of each pin to the outside of the brass tube. Note that a tight fit keeps excess solder out of the inside of the circular waveguide.

Injection Screw

The oscillator injection screw is mounted 45 degrees offset from the perpendicular plane line of the detector flange of the 1/16" pins. A 6-32 screw is inserted into the guide to act as the injection coupling into the detector mount. It controls the amount of oscillator power to inject into the detector diode. It's located 3 9/16" from the rear flange. See Figure 2.

Mount the rear flange to the tube with its bolt holes aligned to the oscillator unit. Make sure the wide internal section of waveguide is in the same plane as the 1/16" pins below the detector mount. Then soft-solder the rear flange. As a last point, soft-solder mount the vanes to hold them more firmly in place.

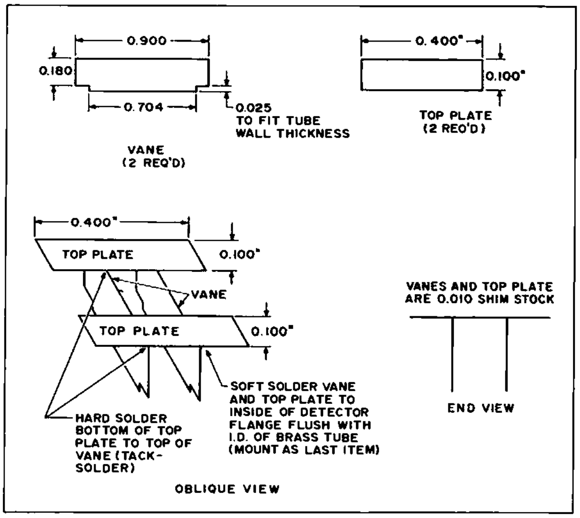


Figure 3. Details of detector vane mounting.

Operation Modes

The input end of the brass pipe is actually a circular waveguide and is operating TE-11 mode. To this flange the Gunn oscillator is attached. Use a home-brew job or a surplus Solfan oscillator. The orientation of the flange and the Gunn oscillator is in respect to the four pins centered in the circular waveguide. They are parallel to the broad face of the Gunn oscillator 1" wide opening (0.9" inside dimensions). See Figure 2. Both flanges are bolted together in normal operation through the four bolt holes located in the corners of the flanges of the Gunn mount and the circular waveguide flange.

Teflon™ Transformer

The neat trick required at this point is coupling the rectangular waveguide to the circular waveguide. The key player is a one inch stock piece of Teflon™ rod, which is cut to fit inside the circular waveguide flush with the end of the flange. Build the Teflon™ transformer by milling or drilling a series of cuts and depressions in the front and rear face. This accomplishes the required transformation from rectangular (TE-10) to circular waveguide (TE-11) mode. Its operation can best be explained one of two ways: A dielectric lens through which the microwave ener-

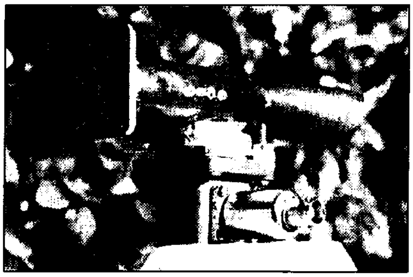


Photo A. Rear view of polaplexer showing Teflon™ transformer and four brass pins on the side of a 1" tube. Detector mounted on polaplexer.

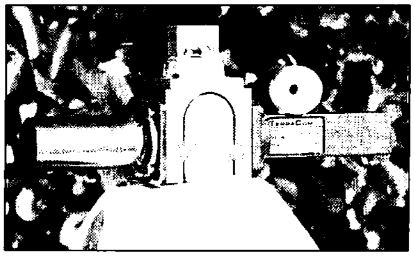


Photo B. Test circulator with short section of circular waveguide. It couples the noise generator to the circular waveguide to allow the evaluation of the polaplexer.

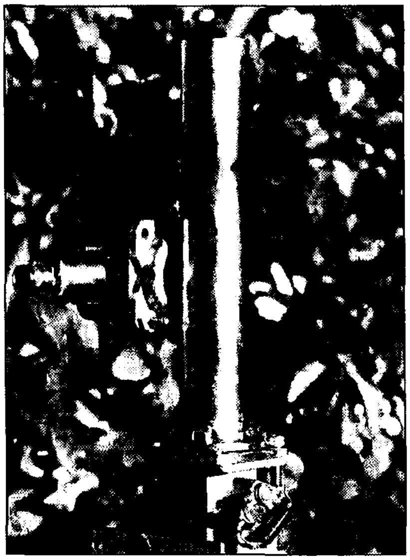


Photo C. Completed polaplexer mount with Solfan Gunn oscillator attached.

gy is forced to travel and arrives after going through the insulating material, in a new relationship in respect to the original signal (plain old obfustication), or just simply black magic! I prefer the latter explanation.

N6IZW, experimenting just for fun, inserted a solid hard rubber *dog ball* in the open end of a radiating waveguide. Its shape made it behave like a lens or magnifying glass which gave (a little) gain to the microwave signal. It collimates the microwave energy into a focused point due to the different travel times through the dog's ball.

Teflon™ Tooling

Machine the Teflon™ transformer to fit inside the brass tube. The transformer resembles a handle-less beer mug with a hole drilled through the center of its bottom. It should be 0.843" long and about 0.930" wide to fit snugly inside the circular waveguide brass tube. Different suppliers have a slightly different wall thickness in their brass tube, so cut to fit the individual tube.

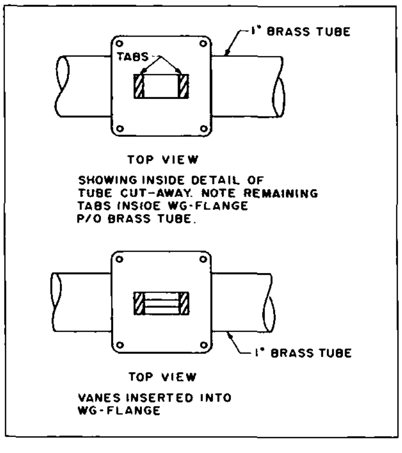


Figure 4. Insertion of the vanes into the waveguide flange.

Photo D. Ed W6OYJ on Mt. Soledad, using the polaplexer, Solfan Gunn oscillator, and home-brew 30 MHz receiver. Ed is looking through a bore-sight tube mounted on the dish.

The center of the Teflon™ is drilled with a 0.218" diameter hole (13/64" drill bit = 0.203") through the Teflon™ center. One end of the Teflon™ transformer is machined out, centered on the 0.218" bore, a 0.750" wide cut 0.031" deep. The other end of the Teflon™ transformer has a similar cut 0.684" wide centered and 0.450" deep. This gives a simple transition between rectangular waveguide (TE 10 mode) and circular (TE 11 mode).

With care, machine the Teflon™ piece on a lathe. I made a perfectly adequate transformer on a drill press using bottom cutting bits for the inside depressions in the Teflon™. Use the center hole of the Teflon™ transformer as a guide placed over a wood dowel, pinned to a large board fixed to the drill table. Using a small end bit, as a mill turning the Teflon™ part on the pin, will control the cut in the soft Teflon™ as to depth and edge cut. It takes some time, but works quite well. Fix the position of the board with one or two clamps to hold the position securely while turning the Teflon™ part. Use safety glasses and care when working with any power tools. See Figure 5 for dimensions on the Teflon™ transformer.

Detector Mount

Refer now to Figure 6. A detector mount using a low noise M/A COMM IN23WG diode attaches about halfway forward on the brass tube to the detector flange. Cut a hole through the brass tube inside the detector flange 0.4" by 0.704" after the flange is hard-soldered to the tube. The detector mount can be a surplus mount or can be built out of a short piece of waveguide.

Gunn Oscillator

It is not important what Gunn oscillator is chosen, all that is needed is a source of 10 GHz energy.

I used one of the Solfan 10 mW output oscillators on my first home-brew project. Set the oscillator near the frequency of interest, say 10.250 GHz, and attach the Gunn oscillator to the rear flange. Couple to the detector flange the diode detector. Make primary adjustments with a current meter in series with the crystal detector. Adjust the depth of the coupling screw (6/32) to obtain about 0.8 mA as indicated on the series meter, then lock the screw in position. Coupling the detector to an IF strip provides a completed full-duplex transceiver. I normally have a single stage low-noise pre-amp between the detector output and IF input. I use a single U-310 FET in grounded gate, feeding one of my single chip receivers operating at 30 MHz (TDA-7000 Signetics chip).

Best DX So Far

The best DX using one of these units with a two foot dish was about 110 miles to Heaps Peak from Mt. Soledad in San Diego by W6OYJ. Ed was using one of my TDA-7000 IF amp receiver boards operating at 30 MHz, approximately 70 kHz bandwidth. The construction of workable microwave transmitters and receivers is not magic—they can be built at home with a limited workshop.

Kit

I have a kit of raw materials to build this polaplexer mount for those not able to find them locally. The kit includes a short section of WG-16 waveguide, a piece of Teflon™ rod, 1/16 brass rods and shim stock for the vanes. Cost is $7.50 post paid. Also available is a 50–100 mW output Gunn diode tested at 10.250 GHz for $5 post paid, or both items for $11 postpaid from the author. Other Gunn diodes tested with output of 100 mW and up are $10 each.

One final piece of advice: Get the *RSGB Handbook*. It's an excellent authority on microwave, a source I wouldn't be without.

I would be glad to answer any questions concerning this project or any other microwave related items. For a prompt reply, please include a SASE. See you on 3 cm! 73

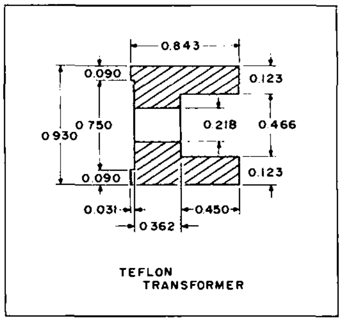


Figure 5. Cut-away profile of a Teflon™ transformer.

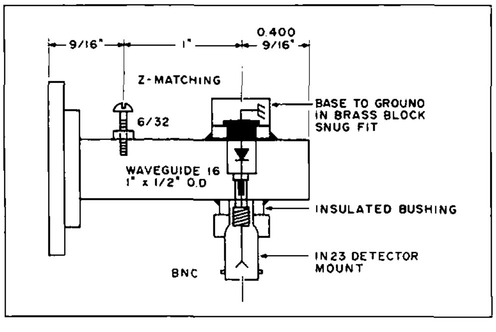


Figure 6. Side view of circular waveguide showing detector mount.

VHF/UHF Tape Antennas

Easy-to-make VHF/UHF copper foil antennas.

by Fred Graham WB3KCZ

Antenna experimentation and construction on the 144 MHz, 220 MHz, and 440 MHz amateur bands is often cheap and convenient due to these frequencies' short wavelengths. One such simple beast is the tape antenna.

Materials	
BNC Female to "F" Male Adapter	Radio Shack #278-256
Copper Foil Tape	"Venture Tape" Venture Tape Corp. 30 Commerce Road Rockland, MA 02370 (617)-871-5964
Plastic Sheet	Mylar,™ Polyester, Acetate, etc. NTC Plastics
TV Matching Transformer	International Model A-MT75-300

An Idea Is Born

I often sketch antenna designs on large engineering graph paper. Frequently, I had to recalculate and redraw the designs to visualize how certain modifications would affect antenna operation. It was while drawing a design for a 440 MHz antenna that I realized that the actual dimensions of the antenna were fitting on my graph paper. Voila!—if I could replace the pencil lines on the paper with a conducting material, I could test the antenna with a transceiver and easily trim and adjust it for best results.

The Materials

Narrow, adhesive-backed copper foil tape used in making stained glass, available in hobby shops, was the perfect choice. When the antenna is laid out on clear Mylar,™ acetate, or polyester sheets, it can be pinned to the wall or ceiling for testing. Modifications are easy to make with an X-acto knife and soldering iron.

The clear plastic sheeting, 0.003" to 0.005" thick, is usually available at art supply stores. I found I could buy rolls 12 feet long and 40 inches wide. These dimensions allowed me to experiment with full-sized, multi-element antennas for two meters.

The following describes a simple folded dipole antenna for 2 meters that can be mounted, for vertical or horizontal polarization, either on the wall or ceiling of the shack with push-pins. It has a professional appearance. Since the folded dipole has a balanced input impedance of 300Ω, I used a TV matching transformer to convert the unbalanced 52Ω output of my handheld to approximately 300Ω at the antenna. These small transformers work quite well up to the 5 watt level and can be used at 440 MHz. I have not tested the transformers beyond 5 watts, but I have loaded them with 300Ω carbon resistors at 440 MHz, and measured virtually no loss or reflected power.

Not Always "492/f"

The resonant physical length of the antenna will vary according to its proximity to the wallboard material on which it is mounted. I have found that mounting the antenna on "Dry Wall" requires about a 20% shortening of the element from the value given by the expression: 492/f (MHz). If the antenna is suspended in free space it will only have to be shortened slightly, i.e. 5%, to compensate for the dielectric constant of the plastic material on which it is mounted. The dimensions given in Figure 1 are for an antenna constructed on polyester sheeting 0.003" thick, mounted directly on "Dry Wall" wallboard.

Although the antenna's length has to be adjusted for proximity to the wallboard, its operation is not otherwise affected. The transmitted and received signals will show dramatic improvement over signals with "rubber duck" antennas. Take care not to mount the antenna near any hidden AC power lines inside the wall. The feedline to the matching transformer can be any length of RG/58 or RG/59 coax, preferably with BNC connectors at each end. Buy an adaptor to convert the BNC connector to the "F" style connector on the matching transformer. Better yet, use a cable with a BNC on one end and an "F" style on the other—this saves both the cost and the electrical loss of the adaptor.

The folded dipole exhibits wider bandwidth than a single conductor dipole—it's possible to cover each of the 144, 220, and 440 MHz bands with a single antenna.

Folded dipoles with other than 300Ω feed impedances are easily built by varying the width and spacing of the dipole conductors. The copper tape is available in widths from 5/32" to ¾". The *ARRL Antenna Book* gives details for various folded dipole feed impedances.

Antennas In The Works

I am presently working on versions of the J-pole, vertical phased array, and log periodic antennas for wall mounting on thin plastic sheets. I am also considering different methods of supporting these antennas and giving them rigidity so they can be hung from the ceiling and directionally rotated.

Conclusion

These two-dimensional copper tape antennas are very easy to put together. They provide an inexpensive and convenient way of experimenting with interesting antenna configurations to use in the VHF and UHF amateur bands. The TV matching transformers work very nicely as broadband 4:1 balun transformers up to 5 watts, and at frequencies as high as 900 MHz. Have fun!

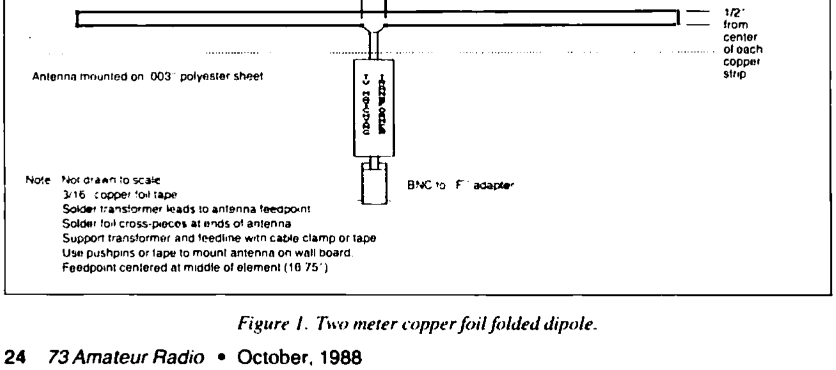


Figure 1. Two meter copper foil folded dipole.

73 Review *by Pete Putman KT2B*

SSB Electronics LT-33S

902 MHz Linear Transverter

Transverters Unlimited
Box 178
New Boston, NH 03070
(603) 547-2213
Price Class: $600

The 33 centimeter band (902–928 MHz) is to many amateurs today what 1296 MHz was 20 years ago: uncharted territory with lots of potential. The increased availability of commercially-manufactured equipment for 23 cm has taken away much of its mystery. SSB Electronics of West Germany has been in the forefront of supplying such equipment with their now-famous LT-23S linear transverter. It stood to reason that when 902 MHz became available, they would follow up with a similar unit, the LT-33S. (Photo A.)

Both the LT-23S and LT-33S share many things in common, not the least of which is overall appearance. The same housing has been used with a slightly modified front panel. From left to right, rocker switches control LO selection, TX, and Power On. A meter has been included to show relative output power—unlike the LT-23S it is illuminated, which is a nice touch.

Rear panel connections are also similar: BNC input for the 144 MHz IF, BNC input for the 902 MHz receive input, and a type N connector at the output of the PA board. Note that (as on the LT-23S) no T/R switching is included and an antenna relay must be added. SSB also brings +13.8 VDC out to a separate binding post which activates on receive and drops out on transmit. This scheme, incidentally, protects mast-mounted preamps, though I still encourage using a sequencer instead.

Most of the circuitry in the LT-33S derives from the 1296 MHz unit. The major difference is in the final amplifier which incorporates a pair of Phillips ON4284 devices in parallel, as opposed to the LT-23S which uses 2 BLU99s in the same configuration. Amplifier operation is in Class AB1 mode, grounded emitter for a truly linear signal. What goes in comes out, whether it be SSB, CW, AM, or FM.

The final amp now uses ON4284 devices because the BLU99s kept failing at 902 during high VSWR stress tests. Conversely, the ON4284 does not have significantly more gain than the BLU99 at 1296; hence the two different types of finals in the two transverters. The good news is that the 902 final configuration produces over 20 watts output saturated, which is a good amount of drive when using an outboard tube amplifier. It's also plenty of power for QRP work as well.

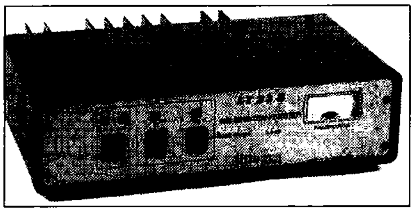


Photo A. SSB Electronics LT-33S 902 MHz transverter.

The front end device is an active RF amplifier using the time-honored Mitsubishi MGF1302, rated at about 1.3 dB noise figure. Early models of the LT-33S ran only 6 watts output and a lesser-quality GaAsFET was selected for the front end. The consequences of this were low gain and poor compression performance! The MGF1302 works much better in this regard, making the unit slightly more of a "bunny rabbit" than an "alligator" (more ears than mouth).

As on the LT-23S, a 144 MHz IF is the standard configuration, although you can special-order 28 MHz IF frequencies. The use of a 144 MHz IF allows for better filtering of the LO signal. With a 28 MHz IF, it would fall at 874 MHz and be considerably more difficult to filter out than if a 2 meter IF was used. In this case, the LO would be at 758 MHz and is easily trapped out. On-board resistors allow drive with up to 12 watts to interface with the popular multimode radios, most of which run 10 watts or have adjustable power output.

Practice shows that a lower drive level results in more linear operation. Typically, 1 to 2 watts drives the transmit mixer and the output is clean and stable. An adjustment for drive is available near the power resistors and it should be set just below the point at which the output saturates—typically in excess of 20 watts.

Performance

I used the LT-33S extensively during the ARRL January VHF Sweepstakes with a Down East Microwave 33 element loop yagi at about 45 feet. The feedline was 9913 (what else?) and no external power amplifier was used. It is certainly a challenge to work DX on a band where activity levels are low and most contacts are made with schedules. It's even more of a challenge with 20 watts, but the LT-33S came through with flying colors.

From my location in FN20, central Bucks County, 22 contacts were made in 6 different grid squares. Several were long-haul to FN42 (W1RIL) and FN32 (WA1MBA). There were many CW schedules and the LT-33S heard them all after some jockeying of the rotor box. No external preamp was used, and I'm not sure one is needed with the stock setup. Should an external amplifier be used, however, it might be worth considering.

One problem (if it could be called that) was extensive warbling of the signal (also called FMing), due to LO instability. I attribute that instability, however, to poor voltage regulation caused by too much of a voltage drop in the DC power leads from an Astron RS-7 supply. This was confirmed in on-the-air tests with K2SMN and WB2WIK, so the power leads were cut to 2 feet. The problem completely disappeared! Another cure for this condition on the LT-23S has been to re-route the coax to the final amplifier with a pair of 90 degree BNC connectors around the LO crystal. (I'm not sure why that latter problem should have existed in the first place, but the fix works 100%.)

The LT-33S was also used on the ARRL 903 Spring Sprint. Its small size and ease of switching are well suited to portable operation and grid-hopping. With a storage battery as the power source, it would be an excellent idea to disconnect the lamp from the power output meter to save on current drain. Such radios as the Yaesu FT-290R are ideally suited for portable IF stages. By using a coax switch and a small 2 meter beam, schedules can be quickly coordinated and completed.

SSB Electronics also makes a 902 transverter kit, using the UEK-3 and USM-3 modules (RX Mixer and TX Mixer). This combination uses a great deal of the circuitry from the LT-33S and the output stage is a BFQ34 running about 5 watts. The advantage of this scheme is that it allows customization of a transverter housing and antenna/DC switching.

Conclusion

The SSB Electronics LT-33S is a well-designed and engineered linear transverter for all-mode operation in the range 902–906 MHz. The front end exhibits excellent sensitivity and the power output is more than adequate for external amplifiers or straight-through operation. It is ideally suited for portable and/or contest operation, which should encourage more 902 MHz grid-hopping! 73

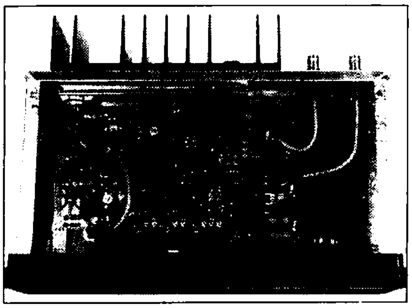


Photo B. Interior view of the LT-33S. This view looks down at the IF board. The PA is on the rear wall.

Portable Re-entrant Cavity Two Meter Antenna

Rubber duck portability with quarter-wave performance!

by Don Morgan W7ACI

This article describes an application of Tucker's design which results in the most satisfactory two meter portable antenna this author has ever used.[1] What makes the design so attractive is that it can be easily stowed for travel, yet is a significant improvement over a duck or a quarter-wave vertical. In addition, it doesn't require radials or a ground plane. A possible disadvantage in the minds of some might be that, because tuning is required, a visual readout device is called for.

Not Much To It

This system is a half-wave vertical fed by a resonant cavity. By visualizing the radiator turned to the horizontal, and an open wire quarter-wave transmission line substituted for the cavity, and a coax feed line tapped in at the 50Ω point on the open wire line, you can see the classic Zepplin antenna design.

The cavity is simply a tin can (coffee or dog food can recommended) approximately 5-6 inches high by about 3 inches in diameter. These dimensions are much shorter than a quarter-wave, but the antenna will be capacitively loaded to resonance. After painting the outside (only) of the can a color of your choice, bore or ream the proper holes for a coax bulkhead connector. One and one-half inches up from the bottom is about right. The center rod is made from any collapsible whip which will extend to 44 or more inches. It should be attached to the bottom center of the can, either with the whip-mounting screw (some whips come with this), or by soldering it with some sort of bracket. Tucker recommends a UG-177/U hood. Whenever attempting to solder to chrome plated brass, it is best to sand off the plating first.

Before installing the whip section, mount the 50 pF capacitor (see Figure 1). We used an air variable cap, but a piston trimmer might do the job if the transmit power is very low. The cavity is a high-Q device capable of developing some surprising voltages. Don't use compression and ceramic trimmers because their configuration makes hand capacitance unavoidable while making adjustments. We designed this antenna to use with an HT—if you use more than a few watts, don't place your finger in the opening of the can while transmitting. Doing so exposes you to a zap and severely detunes the cavity. The outside is "cold" at all times.

Use an SWR bridge for initial tuneup. The three variable quantities to optimize are: the tap point of the feed, the capacitive loading, and the length of the whip. A tap point about one and one-half inches up from the bottom is the place to start. Extend the whip to 38 inches above the top of the can. While feeding RF into the cavity, tune the variable capacitor to about half mesh and watch the SWR meter drop to near zero. If it doesn't, move the tap point up or down a fraction. Once the correct tap point has been found, it will thereafter remain fixed (soldered or clamped) and the variable and whip section can be returned to pre-marked positions each time the antenna is extended for use.

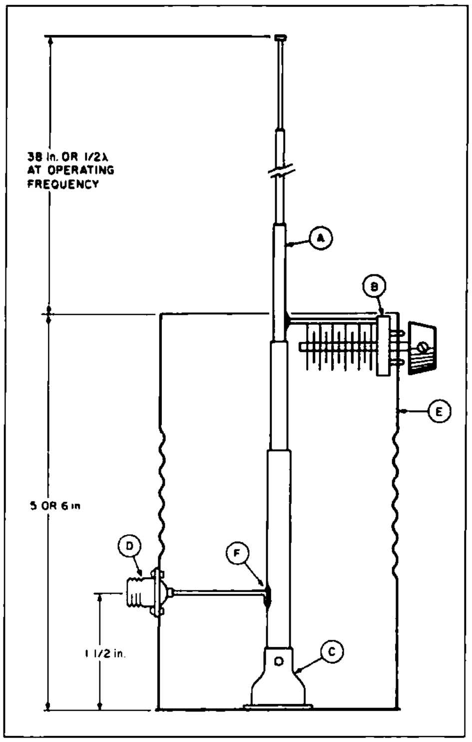


Figure 1. Configuration for the re-entrant cavity antenna. Points A–F are: whip ant., 50 pF cap., SO-239 hood, coax fitting, coffee can, tap point (clamp or solder).

I prefer, however, to retune the capacitor with some sort of readout device, such as a neon bulb or RF sniffer, because it is quite critical. A germanium diode across a 50 or 100 microammeter makes a dandy sniffer. Merely tune for maximum meter deflection (output). Again, Tucker stresses that good bonding of the capacitor rotor to the cavity is an absolute must to avoid hand capacity. A short length of coax from the cavity to the transceiver completes the job. Weighting the can or using magnets and a plastic lid are possible improvements.

Light Comparison

A low-powered handheld using a rubber duck antenna was positioned in front of a field strength meter (set at maximum sensitivity) to make the meter read exactly full scale. The distance between the duck and the meter measured 17 inches. The antenna described in the text was then substituted for the duck, and the procedure was repeated. The distance for a full scale reading increased to 27 inches. The square of the ratio of the two distances, converted to dB, is a fair indication of the "gain" of the half-wave vertical. In this case, the half-wave indicated about a 6.7 dB improvement.

If you like to build things that produce outstanding results, this project is for you. ■

Reference

1. William Tucker W4FXE, "Re-entrant Cavity Antenna For the VHF Bands," appeared in May 1981 issue of *Ham Radio Magazine* (pp. 12-25) and treats the subject in substantially greater detail.

73 Review *by Pete Putman KT2B*

W2DRZ 902 MHz Linear Transverter Module and Sequencer

Tightwad's way to get on 33 cm.

VHF Communications
915 N. Main Street
Jamestown, NY 14701
716-664-6345
Prices: W2DRZ 902 MHz Transceiver $299.00
144 MHz 30 Watt Attenuator/post amp $49.00

I've been saying it all along: You don't necessarily have to spend an arm and a leg to get a signal up and running on 902 MHz!

How nice to be able to substantiate that claim with the W2DRZ 902 MHz transverter, a professionally constructed unit that will take less than 1 mW ot drive at 144 MHz and yield nearly 3 watts output.

Photo A shows the main transverter board, and it's a very compact layout. Note that the transverter is sold without a case. . .This saves the buyer a lew bucks and allows customization when installed. But the unit is complete, requiring only 13.8 VDC, a 2 meter transceiver, and a coaxial relay to switch the antenna between transmit and receive. In addition, an external PC board serves as a power attenuator and IF post-amplifier so that 144 MHz multimodes can be used as the IF source.

Let's take a look at the lineup: The local oscillator employs a 2N5179, running at 94.75 MHz. This is then doubled to 189.5 MHz, then doubled again to 379 MHz. The output at 379 MHz is fed through a interdigital filter and doubled one last time to 758 MHz. This LO signal is taken from a second interdigital filter to knock down harmonics and is injected at about +7 dBm.

The 2 meter IF source comes in through a 10 dB resistive 50Ω pad. In theory, the user will employ the outboard attenuator board and reduce the input signal to about 10 mW at the IF input. This means only 1 mW of drive is required to drive the mixer, which is a Mini Circuits SRA-5 diode ring mixer. Being a passive diode ring mixer rather than an active type, it exhibits some conversion loss, but has high dynamic range–a typical characteristic of diode mixers.

The output is fed through a PIN diode switch array and then to a CGY21 power GaAsFET,

Photo A. Top view of the W2DRZ 902 MHz linear transverter. TX/RX connectors are to the left, and 144 MHz IF IN/OUT to the right.

developing about 8 dBm at 900 MHz. To minimize spurious outputs, a Toko 3 section helical filter follows the CGY21. This filter has a -3 dB bandwidth of about 15 MHz, ensuring a clean signal. Incidentally, all units come tuned for a 902 MHz center frequency, but can be easily retuned for operation higher in the band.

The buffer, driver and final amplifiers are located after an on-board 50Ω relay which switches low level TX and RX signals. A second CGY21 provides about 22–25 dB gain and in turn drives an MRF557 to about 500 mW output. The final device is an MRF839, developing 2 watts across 50Ω. This latter device can actually make up to 5 watts output, but begins to compress at about 2.5 watts. W2DRZ suggests running no more than 2 watts to run a clean, linear signal.

The receive section is simple: 902 MHz signals are fed through the on-board 50Ω relay to the same CGY21 used as the first low-level amplifier, then back through the SRA-5 mixer. That's it! The manufacturer claims a 5 dB noise figure for the CGY21. As a result, W2DRZ strongly recommends a good low-noise GaAsFET ahead of the receive input, preferably with about 15 dB gain or so. But as you'll see momentarily, the power GaAsFET gives a good accounting of itself.

My initial tests with the unit were done with no chassis enclosure. This transverter doesn't seem to care where it's set up. . .the output remains constant and the receiver is quite stable. If you've had your fill of unstable LOs, or oscillating receiver sections, this will be a welcome relief! To obtain output, I initially used an HP608F Generator (with Boonton 92 to measure input levels) and a Bird 43 with a 5 watt 400–1000 MHz slug and 25 watt Termaline:

Performance Measurements

Linear Output Power

Input Level	Output Power
-10 dBm	700 mW
-7 dBm	1.5 W
-4 dBm	3.0 W
-3 dBm	3.5 W*
-2 dBm	4.0 W
-1 dBm	4.5 W
0 dBm	5.0 W**

(NOTES: *—Transverter is in compression and non-linear at 3.5 watts output.
**—Transverter heavily saturated at 5 watts output.)

As far as the receiver performance goes, I was not able to make detailed tests as my signal generator cuts off at 450 MHz, so instead I relied on over-the-air observations, specifically with the N3CX beacon on 903.080 MHz 25 miles distant. Comparisons were made against an SSB Electronics LT33S which has a sensitive front end and noise figure of under 1.5 dB.

The W2DRZ Transverter held its own very well against the LT33S, which is impressive because the front-end comparison is between a small-signal low-noise GaAsFET (MGF 1402) and a power GaAsFET (CGY21)! Based on my results, it would appear that the noise figure of the W2DRZ unit is probably closer to 2–2.5 dB and not the 5 dB claimed by the manufacturer, which was understandably done to be conservative!

A 12–15 dB GaAsFET ahead of the W2DRZ unit would probably result in a very sensitive front end with high dynamic range, as the power GaAsFET/diode mixer combination saturates at about -12 dBm input. This would result in a 1 dB compression point of about +8 dBm output, which is excellent by any standard! What this means to a 902 user is relative immunity from front-end overload by UHF TV stations or other nearby high-power RF sources, and the resultant IMD products.

Conclusions

In all, the ratings for the W2DRZ 902 MHZ transverter are quite conservative. The output of 2 watts is sufficient to drive a gain block to 20 watts, which is plenty of power for everyday work. Since the unit is linear, SSB, CW and FM modes can be used. The receiver is sensitive enough out of the box for everyday work, but a modest low-noise preamp will make a difference. The overall construction quality is excellent, and the modular system approach makes completing your 902 station a snap. It's a winner!

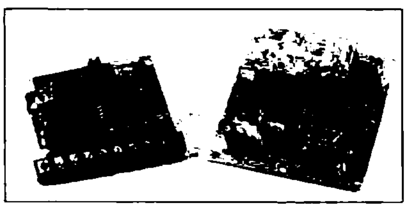


Photo B. The accessory sequencer board (left) and attenuator/postamp board (right). A 30 watt 2 meter multimode may be used as the IF.

The Pee Wee Thirty Transceiver

A compact 30 meter CW/AM QRP transceiver (Part II)

by Dan Eggert AC9E

After completing the assembly and powering-up of the rig, check the following list of key point receiver voltages. Use circuit ground as a reference point for these measurements. I used a 12.5 volt source to establish these following voltage values.

1. Cathode of ZD1 6.5V
2. Cathode of ZD2 6.5V
3. Pin 5 of IC1 3.7V
4. Pin 8 of IC1 7.5V
5. Pin 6 of IC2 11.8V
6. C41 +9.9V

Your measurements should be within 15% of these. They help spot a major construction error right off, and could save you from a lot of grief!

Next, after putting out the fires and clearing the smoke, align the IF stages. Builders with access only to a frequency counter can use the BFO as a 455 kHz signal generator. I used this simple alignment procedure on one of my rigs, and it worked very nicely.

As shown in Figure 7, remove the wire from switch S3B that comes from C24 on the circuit board, and connect it across a 10k potentiometer to ground. Connect a 0.01µF capacitor on the wiper of the potentiometer. With the BFO turned on (switch S3 to CW) and a frequency counter connected across the potentiomer, adjust T8 for 455 kHz. T8 was a fairly touchy adjustment on my rigs, so try to get it as close to 455 kHz as possible. Use the BFO's front panel control for fine tuning. You now have a crude, but adequate, signal generator with a variable output attenuator for 455 kHz!

Remove the wire from S3B that comes from the cathodes of D3 and D4 on the circuit board (again see Figure 7). Connect a 10kΩ resistor and about a 1µF capacitor in parallel from this wire to ground. Connect a voltmeter across the resistor and capacitor, and set it up to measure 1 volt DC. Remove the wire from S2 that comes from ZD1 on the circuit board to disable the local oscillators. Adjust the receiver's gain control potentiometer for maximum sensitivity.

During the IF alignment, make sure that the signal source stays on, or as close as possible to, 455 kHz. Throughout the alignment, always keep the signal generator's output at a level enough to adjust transformers' T3, T4, and T5 for a peak of about 0.75 volts on the voltmeter. It may also be necessary to lower the receiver gain during the alignment to maintain the 0.75 volt peak. With a 455 kHz signal source connected at the output of T4 (gate of Q4), adjust T5 for a peak on the meter. Move the signal source to the output of T3 (the gate of Q3), and adjust T4 for a peak on the meter. Move the signal source to the output of T2 (gate of Q2), and adjust T3 for a peak on the meter.

Repeat the alignment of T3, T4, and T5 again, but keep the signal source at the output of T2 (gate of Q2). Use the highest receiver gain setting possible, and the lowest signal source input level that is needed for a peak of 0.75 volts on the meter. Reconnect the wires previously removed from S2 and S3, and restore the circuit to its normal configuration. Check the local oscillator(s) by placing a frequency counter at the circuit connection of R4, C5, and the gate of Q2.

For the tunable version, switch the tunable oscillator on and adjust T7 for the proper front panel tuning range desired (RX frequency is 455 kHz), or just simply play around with this adjustment with an antenna connected to the rig later. Preset trimmer capacitors C13 and C14 to mid-range. With the crystal oscillator switched on, adjust T6 for the frequency of the crystal selected. The best way to align T6 is to use a scope at this test point and adjust T6 for a peak output. Builders without an RF signal generator for the receiver alignment can peak T1 and T2 while receiving a weak signal with a fairly constant signal strength. The peak in T1 is not sharp, however, and it is somewhat hard to recognize.

On one of my rigs, T2 peaked at a point where the tuning slug almost bottomed out. To avoid this, solder a very small-value capacitor across the primary of this transformer on the solder side of the circuit board if necessary to lower the tuning range.

If you didn't use the BFO as a signal source for the receiver alignment, then adjust T8 for a BFO output frequency of 455 kHz with the BFO tuning control at mid-range. If you used an RF signal generator for the receiver alignment, and a frequency counter was not obtainable, then inject a 455 kHz signal through the IF stages and adjust T8 for a zero beat when in CW mode. The receiver should now be ready to tune in the world!

Transmitter tune-up is very simple. With the rig connected to a wattmeter and dummy load, adjust the oscillator trimmer C5, and then the output trimmer C11 for maximum output power. Repeat the adjustments again for maximum output. Adjust the crystal trimmers C2 and C3 for the desired crystal output frequencies with a frequency counter, if available.

With the transceiver on a dummy load and keyed, adjust the receiver's crystal trimmers C13 and C14 so that the side tone heard in the receiver is the same with either frequency selected.

Conclusions

The rig design is basic, but most improvements would involve a lot of extra construction and redesign. My main goal was to develop an inexpensive, simple, and fun-to-operate rig.

It's quite possible to work good DX on the Pee-Wee 30—I just recently received an S-7 report from a ham on the Caribbean island of Grenada. QSOs like these are very satisfying on a QRP homebrew rig putting out only about two watts. QRPing is a joy to the ham who truly likes a challenge. Join the fun! 73

The component kit, including PC board, is available for $95 from Hobby Electronics, PO Box 44247, Denver, CO 80201. Ask for kit #H73001. The PC board alone is available for $35.

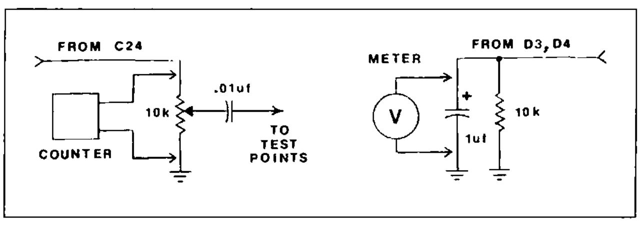


Figure 7. Frequency counter and volt meter connections to aid receiver alignment.

Passions of the Ether

Hams and their reasons to be

by Steven K. Roberts N4RVE

It is a rare treat for a writer to contemplate a blank screen on the eve of deadline, trying to get in the mood and feel the audience then suddenly realize that with every reader he shares a single potent passion. Ham radio is more than a mere vertical market—it's obsession, religion, and lifestyle of choice for a diverse scattering of technoid humanity. This touches me with something approaching poignance, spawning a temporary departure from the usual theme of this series.

Actually, what started all this was a sort of introspection, the kind of analysis that accompanies any personal expenditure of man-years and kilobucks. Why am I doing this?

Growing Pains

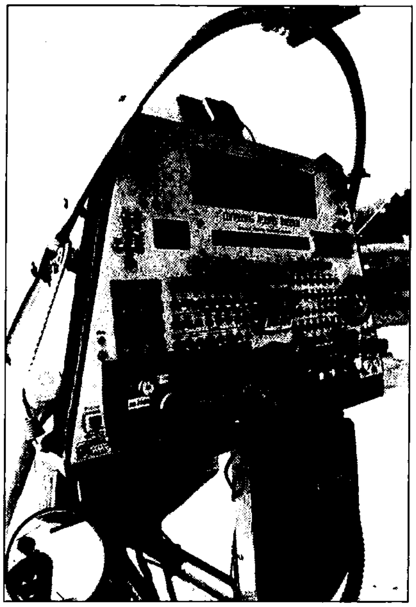
As you have probably noticed from my recent articles about the Winnebiko, my high-tech nomadness is getting out of hand. The OSCAR Mode L station is now under construction; I can operate 80–10 HF while camped and 10-6-2 FM-SSB-CW while pedaling; the bicycle-mobile packet station includes a BBS; and I'm seriously considering trying ATV with a Sony 8mm video system. Both bicycle trailers are being rebuilt with 55 watts each of additional Solarex PV modules, and I'm using Tedlar™ substrate material with a bonded shielding layer to build a dedicated pop-up operating position for the whole lightweight "shack." The 70- and 23-cm OSCAR beams break down and ride in a foam-lined drawer under the trailer, the extendable mast supports five different antennas and a preamp, and in addition to all this, there are expanded computer systems, nav/mapping systems, a voice-data-fax cellular phone with answering machine, and much more.

So what madness drives me to dedicate all available resources to a gizmological *tour de force* that, put crudely, merely lets me travel around in slow, high-risk discomfort while chatting occasionally with fellow techies?

I started pondering this question as a sort of intellectual background task last month while visiting WA4ONG in Richmond. Jim is building a new house, and we rented a U-Haul to pick up his new 170-foot Rohn 55G tower a hundred miles north at EEB. He's looking for a few hundred feet of fiber-optic cable to control an all-band IC-900 at tower-base from the house. He just set up an all-mode satellite station with the largest possible beams, another tower, and fully-automatic AZ-EL tracking and transceiver tuning under control of a dedicated PC. This same ham also operates a busy 4-port packet BBS with online CD-ROM call directory, and extends his coverage with a remote site or two. Why does he do it?

"Well, there's a bit of the anarchist in me," he said. "In fact, it irritates me to register my tower with the FAA."

As I write this, I'm visiting another Jim—AB4CZ in Norcross, Georgia. We're parked in his driveway in our temporary mother ship (a 35-foot school bus that lets us make the rounds of manufacturers, clients, hamfests, and trade shows while hustling books and working on the new bike system). I sit here keytapping in his driveway, my fingers dancing to the rhythms of Bob James, while our host pursues the passion. I see him up there clambering across the steep roof, risking his life with a sore back to replace the 3/8-wave



20-meter vertical with a new beam, dropping another run of coax along the fat bundle that already links his covenant-stretching suburban antenna farm to a room full of equipment. His bride of two weeks attempts to involve him in domestic activities, but he will have none of it this afternoon. His eyes are gleaming with radio waves. Why?

"I feel a strong pride in my ability to communicate over long distances. All my life I've really loved radio..."

Everywhere we go it's like this. Rooms papered with QSLs, relations with neighbors strained by skyhooks, budgets reeling under new gear, late nights digging through QRM in the quest for a ZA or an SU, impromptu on-air gatherings dedicated to quantifying the incremental improvement in somebody's audio hams across the land are crazy with the urge to communicate.

What Makes Radio Special?

The computer hobby was like this during its short life in the 70's, but as it matured from wire-wrapped 8008s to the epoch of software superstores, it quickly evolved from toy to tool. When I found my dear old BEHEMOTH plastered with tax charts and schedules, something happened to the thrill. Computers have become like oscilloscopes and milling machines: tools of exquisite beauty, gateways to other passions, high-tech chameleons that change color and form with a whim and a keystroke.

Perhaps the computer hobby was prevented from reaching amateur radio proportions by a device technology that packages insane complexity into untinkerable modules—a technology that either works or doesn't, offering none of the tweakings and mysterious RF tricks that we hams both love and hate.

But ah, radio. What else can span cultures, thrill us with raw power, enchant us with magic while puzzling us with complexity, challenge the intellect, satisfy the urge to compete, dazzle onlookers, serve the public, guarantee a circle of friends, reward in proportion to effort, offer security in strange places, bring out the anarchist lurking within, offer a constant flow of irresistable new toys to keep the checkbook depleted, and tie it all together with a tingling undercurrent of fun? What else could drive me to further burden an already-overloaded bicycle, something I swore I'd never do? What else could make you browse this issue of *73* and lust after boxes, Birds, and Butternuts with all the tight-chested urgency of youthful desire?

Go on, admit it. You concoct elaborate justifications, but your purchases and projects are based on passion.

OK. Let's pin it down. What kind of passion? The more I travel among hams, the more I see a discrete set of motives lying behind the mad pursuit of signals through the ether. How many of these basic ham-types apply to YOU?

The Anarchist

In these days of insane politics, candidates of dubious motives, terrorists, scattered mini-wars, and earnest discussions of mad Star Wars pursuits, it is tempting to dedicate energy to the elimination (or at least the avoidance) of governments. Forget your nationalism for a moment and join me in a quick fantasy....

We're cruising the Galaxy in a starship, and broad-spectrum electromagnetic activity with a higher-than-normal autocorrelation function suggests life on a blue-green planet.

Discreetly we hover, all sensors on. Initial conclusion: a single intertwined ecosystem, dominated by a single intelligent species.

Looking closer and extracting meaning from the jumble of transmissions, however, we begin to observe that the planet is crisscrossed with boundaries, some following natural geographic features, others imaginary. Different abstract regions, populated by the same species, spend 10-20% of every individual's income on the tools of warfare. Humans crossing imaginary lines can be harrassed, searched, taxed, imprisoned, or killed. Artificial trade restrictions exist, raising the overhead of living.

Radio waves have no respect for borders. When they are wielded by humans who feel likewise, the result is a refreshing sense of freedom from the artificial constraints of governmental policy. Even though an American ham can't ask an Irish ham to call a friend in Dublin, the capability is there; even though there are places where ham radios are considered spy equipment, it's good to know that if it all hits the fan, we amateurs will be there to help knit humans together. Every new station, be it a packet BBS or a 1.2 Gig HT, adds to the general ability of our species to keep itself from dissolution.

The Survivalist

Closely related to the Anarchist is the Survivalist, but the motives are more personal, less related to politics than preparedness. We have recently seen the effects of massive single-point failure in communication systems, when that switch in Illinois crashed and left thousands without information links.

There is genuine satisfaction in owning equipment that will work when commercial services are shut down by disaster, war, or economic collapse. This is one of the pleasures of my bicycle, in fact. Not only does all the equipment run on solar power, but so does the bike itself. The personal effect of an American information/power/fuel disaster would be softened by the presence of radio systems that keep right on working under natural power, assuming that no NEMP has come along to blow away all my chips.

The World Citizen

Culturally, ham radio can be described as a global door-opener. Peace and understanding among various aggregates of Earth's citizens depend more on communication than anything else (something fully realized by totalitarian leaders who do their best to prevent it). We have been conditioned to believe that difference means danger, that at any level of magnification, world affairs reduce to a paranoid "US versus THEM" formula.

Politics aside, the easiest way to fix this illness is to simply communicate (interactively, not just by watching the occasional PBS documentary about the rituals of Zambian natives or Russian holiday fashions). Hams are in a unique position to spread a demystifying awareness among their fellow citizens—spending hours in relaxed conversation with new friends worldwide, they realize that they're not all that different.

Talk to aliens beyond the QTH and signal-report level. Discover that they're not aliens after all. Share those insights with ethnocentric Americans, and realize that you're helping save the world.

The Social Animal

Of course, not all hams want to think globally. There's nothing intrinsic to a radio that forces its user's mind to open. That's OK—there are plenty of other good reasons to do this.

Consider the neighborhood. If yours is like the ones I knew before moving to a bicycle, it is a random assemblage of not-necessarily compatible people cast together by economic strata and chance. The contrasts can be absurd. Both Jims mentioned earlier are harrassed at some level by their neighbors for antennas and unsightly visiting nomad buses, while the neighbors' goal in life is a perfectly manicured lawn and a clean Cadillac.

This seems a strange way to live—to be cast into physical proximity with those of incompatible natures. It's one of the driving forces behind my continued wandering. I prowl the land in search of exceptions.

The social ham, like the computer networker, has discovered a solution to the problem. When you go on the air, your neighborhood becomes virtual, whether the scale is global or repeater-wide. Your contact is brain-to-brain (not face-to-face), and the effects are interesting. First, when it doesn't matter what your friends look like, you can make some astonishing connections. Second, when their location is no more important than their alma mater, your relationships are not constrained by geography. From the folksy Possum-Trot net to the Sunday morning meetings of old friends on 40 meters, hams have found ways to step outside the boundaries of their physical neighborhoods.

This has led me to make my home in Dataspace, a not-land where bigotry is obsolete and geography falls apart. Hams have known this for decades, and often see the physical reality of suburbia as an insignificant backdrop for their real life, instead of the mind-numbing trap that it can so easily become.

The Socially-Inhibited

Then there's the other side of the same issue. Some people don't have a choice. They are shunned. Perhaps scar tissue or deformity makes them hard for style-conscious Americans to face. Perhaps they're fat, ugly, or confined to a wheelchair. Maybe their speech is made tortuous by cerebral palsy or stuttering. Maybe they're a minority race in the wrong part of town—or female and techno-brilliant in a culture that frowns on that tendency in "girls."

The point is, ham radio can open communications channels while hiding whatever it is that makes normal socializing difficult. While anonymity can be abused (especially in the computer networks), it can save the very lives of those driven into desperate loneliness by their appearance.

There's a brain in every body, even if the face doesn't meet current standards or the peripherals don't all work. If you know someone like this, dying slowly of intellectual neglect, take the time to demonstrate ham radio. You may make a life worth living....

The Public Servant

I've always been fascinated by this much-publicized aspect of ham radio. Individuals build communication systems on behalf of society, out of pocket, without pay, often taking time off from work when volunteer radio duty calls. It takes a variety of forms, ranging from building packet mail-forwarding systems to manning a disaster-relief nerve center, and the motives behind it are among the most noble of any in our culture. There really are people whose need to help other people, even strangers, is a major personal priority.

Actually, there are two forces at work here. One is the humanitarian support of those in trouble (or practice for real emergencies by helping at public events), and the other is the creation of systems that keep communication flowing without cost or corporate substrate. The former is easy to undersand, but the latter is not so obvious.

What, exactly, drives a ham to spend thousands of dollars to bring a new packet BBS online? I think we'll find that it spans most of the other motives in this article, from being the biggest digital signal on the block, to the seductive delights of technology, to the hope that all our communication eggs don't end up in an expensive and volatile government basket. When you consider the cost of such a station can run $10,000 or more, the power of the motives behind it becomes obvious.

And what about AMSAT? The packet satellites going up next January will be cheap at about $40,000 each, and the OSCAR 13 system just launched has been estimated at roughly $2 million. This not casual tinkering, folks, this is passion.

The Good Samaritan

Of course, there are thousands of low-budget hams who live far from the big projects. They never participate in emergency preparedness exercises, and may even grumble when their favorite repeater is tied up all day by logistical support for a 10K run.

But these same folks would elbow each other aside in the rush to help a stranded motorist or call the police about a drunk driver. Whether it's our familiar need to help our fellow man, or a less-noble desire to justify the money spent on radios, may be hard to tell, but the net effect is an ad hoc cadre of concerned citizens with radios.

I have felt deep satisfaction in stopping my bike to help stranded motorists, and though I am of little use for towing or jump-starting, I can sure do something about calling for help.

Perhaps this sort of thing also exonerates us a bit, making our obsession with new toys seem a bit less selfish....

The Sportsman

And then there's the scoring culture. For many hams, DX contacts are not so much cultural interconnections as fodder for the

coveted "Worked More Than 100 Countries on Less Than 33 Watts While Eating Burritos in the Snow" award. These contacts have a formula look about them, and there have been rumors of robot contest ops that compete effectively.

Some people run contests for the glory. Others for the exercise. Others for a concentrated dose of that enchantment that comes with working every new state or country (I ran about 150 QSOs on Field Day as a casual one-delta for this reason). Some do it to receive external, objective feedback on the effectiveness of their station. And still others do it to add excitement to the process of advancing the state of the art in communication techniques (collecting meteor-scatter grid squares).

As with most aspects of ham radio, the question of motive is mired in complexity. Clearly, there is thrill in competition, and some of the more sophisticated forms of "radiosport" reward not the bucks spent on big guns, but the hours spent on fine-tuning receive efficiency and operating skills.

The Showoff

But some people have no such motives—or if they do, they're secondary to the feeding of an overgrown ego. You meet them occasionally on the air; it seems that every club has one. Outlandish claims of technical derring-do are always afloat when this bozo is around, and be careful lest you become drawn unwillingly into a battle of one-upmanship.

Ham radio can be appealing to the egotist, for a new audience is only a CQ away and verification of lies is next to impossible. This kind of person cannot survive in a closed community, and so turns to short-term relationships to feed the habit of trying to impress everyone. And with the full range of this complex hobby available as fodder for invented experiences, he can get away with it for quite a while before other hams start experiencing mysterious local QRM after being dragged into a QSO with him.

The Practical Ham

This one's easy, and also common. There are four ways to stay in touch with the world from your car: cellular phone, CB, business radio, and ham radio. The first is expensive and non-social, but very reliable and quiet near cities; the second is culturally useless, but occasionally handy on the Interstate; the third involves business licensing and expensive hardware; the fourth is easy, fun, reliable, and affordable. I have met a number of hams who got their license only for the ability to autopatch home every afternoon and say, "Honey, I'm on the way. Need anything?"

Maggie KA8ZYW joined me electronically as a condition of the high-tech nomad job. Getting there was a big challenge for one whose life had been spent far removed from technology, but she did it, and it has not only kept us in constant contact, but has nearly doubled our range of on-the-road relationships. Ain't technology wonderful?

I would broaden this category to include safety. I have often pedaled into the ragged end of an unfamiliar city, paused by the road to store all the local repeaters in memory, then pressed on with the reassurance of an occasional reset beep in response to my left thumb.

And for some people, ham radio is all that's available. In the wilds of Nevada, there are whole communities without telephones that are linked together via a mountaintop repeater and local hams.

The System-Beater

Any comparison between ham radio and other communication links brings up another point. Some hams have discovered that routine personal long distance conversation is free via radio and expensive via phone. That sounds like a good stand alone reason for getting a license, even if you're not interested in socializing or exploring the technology.

The Tinkerer

Ah, the urge. Tinkering goes with radio the way clambering goes with mountains. The combination of the latest magazines and a robust junkbox is seductive and irresistable. The acrid smells of solder and silicone, the warm convective flow that spells victory in the smoke test, the probing touch of meter and scope. Graticules in the night. Dragging a clip lead from the clutter of your bench, shaking off a litter of excised caps and unnameable bits of electronic detritus from past projects. Stepping barefoot with a shout on an upended DIP. Ripping open padded bags from mailorder parts houses. Poring through flea market bins, your mind a confusion of possibilities locked in mortal conflict with economic reality. Hauling your new widget-framus over to a friend's house to use the signal generator. Making the HW-8 better. It never ends, and never should. This is ham radio's essential nature, and may there never be a day when we all become appliance-ops!

The Gadget Freak

But there's another side to the love of hardware. Did you sit in the numbing torpor of grade school, keeping awake during the drone of history class by drawing magnificent pictures of your future laboratory?

Do you thrill to the IC-781, reach across hamfest vendor tables to feel the dials, and imagine your house bristling with log periodics, discones, rhombics, and helices? Do you periodically clean up the shack (especially upon receiving a new piece of equipment), then sit back and gaze at it all in a sort of marveling fog?

If so, you're a gadget freak. You want all new electronic toys, and find their acquisition at least as exciting as their use.

The Magician

Early in this series, I related an event that took place during one of my first forays into HF QRP. I spoke of the sliced rock in the Virginia sunshine that pumped current into a box of chemicals, conjuring a few Megahertz of RF modulated by my wiggling fingers and shoved out to a wire in the trees. Across the ocean, 6000 miles away, a stranger heard the disturbance in the ether and responded. Soon we were becoming friends through something best described as magic.

Despite Maxwell's equations and the sciences of propagation and antenna design, there is something arcane and wonderful about radio. Computers work with digital perfection, cars run as long as you keep 'em oiled, but radio waves behave on the whims of sunspots, meteor trails, ionospheres and tropospheres. You can never know everything about it, and thus there are always surprises and confusions, wonders and delights. Hopping around the globe through a little box on your desk, hearing exotic places calling from deep within a tangled spectrum of voices and carriers . this is something as much in the blood of radio as the triode-burned fingertip and the dittybop of code practice. And now we have EME, and OSCAR, and much more to keep our eyes wide with wonder as we refine our skills and peel away the obscuring mysteries.

The Explorer

For the scientist, of course, all this translates into invention and discovery. How much effective bandwidth can be crammed into a 5 kHz channel, anyway? Will a lot of spread-spectrum stations raise the noise floor? Which is better, a lot of directors or a phased array?

How can the packet network become interwoven so deeply that it becomes self-maintaining and invisible to the users? Can you predict tropospheric ducting? Ham radio can keep you exploring for a lifetime, even if you couldn't care less about today's WX in EA8-land.

The Teacher

For decades, of course, ham radio has had a life of its own. It has become populated by people of such diverse motives that it is increasingly hard to make generalizations.

But some hams, in love with the spirit of the hobby, dedicate themselves to keeping it fueled with new blood. School programs, video tapes, Elmerizing . . . all this reminds me of Bradbury's *Fahrenheit 451* in which people "became" their favorite books so that literature wouldn't die under a repressive regime. Keeping the spirit alive is a tradition in ham radio, and has a lot to do with preventing the median age from advancing even faster than it does.

And so there we have it. A marathon overview of the motives that drive otherwise sane people to fling themselves into the ham radio passion. How many of these "types" did you recognize in yourself? I am a blend of twelve of them, and I'm sure that's not at all unusual.

Whatever your motives, please share them with others. Keep ham radio thriving in all possible ways. And if you happen to see a couple of loonies pedaling their stations past your QTH, invite 'em in for a beer. Cheers and 73's from the road!!!

Antenna Systems—Part 2

W3ZC continues to dispel popular antenna system misconceptions.

by John Lawson W3ZC

In Part 1 (September 1988 *73*), I stated the ideal of a matched antenna system—that antenna, transmission line, and transmitter output impedances are all 50Ω. This, however, is not usually the case. Amateurs are not single frequency operators, and we know that antenna impedance changes with frequency of operation. How to match (or come reasonably close to matching) impedances?

Assume you have a beam and you want to feed it with 50Ω RG-8/U coax. There are several factors to take into account. First, coax is unbalanced transmission line—almost all the current travels in the inner conductor, with very little, if any, in the shield. Second, the driven element of a beam is much like a dipole. It is a balanced antenna. It expects equal currents to flow on each side of the feed point. With directors and reflectors, it has an impedance of around 15Ω (dependent primarily on the element spacing). The problems therefore are to change from an unbalanced to a balanced configuration, and to match the beam impedance of 15Ω with the coax impedance of 50Ω.

Balun

One way to do both of these tasks is with a balun (contraction for "balanced-to-unbalanced.") This is really a transformer with a ferrite core.

A 4:1 balun does both jobs. The problem with a balun is that, at the band edges, especially with a wide spaced beam, the mismatch is high, causing the ferrite core to heat up if you're running considerable power. There are also environmental considerations with a balun. The balun core can corrode, changing its characteristics.

Most hams get around this by using a coil of coax, in which the shield acts as a matching stub and performs the impedance transformation. This configuration is almost entirely reactive and consumes very little power even at the band edges where mismatches are usually greater. There may be a space problem regarding where to place this coil of coax, but up on the tower it's usually out of the way.

Antenna Gain

This term tends to confuse people, because it implies an increase in total energy after going though a given antenna system. What gain really is, however, is a ratio between the strengths of *useful* radiation patterns of two antennas. These two antennas are the reference antenna, and the antenna to compare to the reference, both with the same input energy. The units are usually given in decibels, or dB. Note that the "gain" that we see is merely a redistribution, or rearrangement, of the supplied energy. The more the supplied energy is concentrated into the useful radiation patterns, the more gain that antenna has.

In HF antennas, a common standard of comparison is the isotropic radiator. This is a hypothetical antenna that radiates equally well in all directions. Another common reference antenna is a half-wave dipole in free space, which has a little over 2 dB gain, in reference to an isotropic radiator. Its pattern appears from the top view as a pair of opposing ellipses, both emanating from the feed point. As viewed from the end, the pattern is circular. Some of the pattern energy is not useful—for example, the portion of the field that radiates straight up or straight down is usually wasted. Antenna engineers can design systems that take this unusable energy and redistribute it into the side lobes, thus increasing the field intensity of the side lobes.

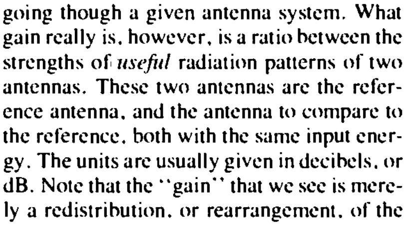


Figure 12. Typical balun used to isolate a grounded source from a load (antenna).

Beams and parabolic reflectors take this "concentrating" further. Instead of a bidirectional pattern, as with a dipole, they focus the available energy into a single direction, attaining larger, more directive, gains.

A word of caution. Advertisers' antenna gain figures often don't tell the whole story—they often don't give the reference antenna. When you read about an antenna having a given gain, you don't know whether it's in reference to an isotropic antenna, a half-wave dipole in free space, or some other reference. Manufacturers use different standards. Always ask "the gain over what?"

Wrapping Up

The following statements sum up this two part series.

1. In any antenna system consisting of carefully selected quality components, don't bother trying to get the SWR below 2:1. Any further work to reduce an SWR of 2:1 on any coaxial line will be completely wasted from the standpoint of increasing power transfer significantly.
2. Low SWR alone is not proof of a good quality antenna system, or that it is working efficiently. Low SWR with a suspicious antenna can indicate that something else is wrong.
3. SWR in the antenna system is determined *only* by the matching condition at the antenna, and is *not* changed or brought down by any matching device, such as a Transmatch, installed at the input end of the transmission line. Low SWR obtained by using a matching device at the input indicates that the output of the transmitter and the input to the antenna *system* are matched and that maximum power

will be transferred. The SWR between the feedline and the antenna remains unchanged.

4. Adjusting any matching device placed at the input of the transmission line, such as Transmatch, L match, T match, or the transmitter output tuning, for maximum transmission line current creates a perfect mirror or conjugate termination for the reflected wave. The reflected wave, therefore, is totally re-reflected upon arrival at the transmission line input. The tuner gives the proper mismatch cancelling reactance to effect this action. The reflected wave is re-reflected **in phase** with the transmitter output wave, the sum of which constitutes the incident power.

> ***"Low SWR alone is not proof of a good quality antenna system."***

5. If a suitable matching device (such as a Transmatch) cancels all of the reactance developed by a non-resonant length radiator and a random length feedline which is mismatched at the antenna feed point, the antenna system is resonant, the mismatch effect is cancelled, maximum current flows in the radiator, and all real power available at the feed point is absorbed by the radiator.

A. The radiator of an antenna system need *not* be of self-resonant length for maximum resonant current flow.

B. The transmission line length need *not* be any particular length.

C. A substantial mismatch at the transmission line antenna junction will *not* prevent the radiator from absorbing *all* real power available at the junction.

6. Reflected power does not represent lost power over that which exists in a matched situation, except for an increase in transmission line attenuation losses. In a loss-less transmission line, no power is lost because of reflection. Only when the matched line attenuation and the SWR are both high is there significant power lost from reflection. On HF bands using low-loss cable, reflected power loss is generally insignificant. At VHF, however, it becomes significant, and at UHF and higher, it is critical.

7. Total re-reflection of the reflected power at the transmission line input is the reason for its *not* being dissipated in the transmitter. It is conserved rather than lost.

8. Reflected power does *not* flow back into the transmitter and cause dissipation and other damage. Damage blamed on reflections is really caused by improper output coupling—not by SWR. Tube overheating is caused by overcoupling, mistuned loading, or both. Tank coil heating and arc-overs result from a rise in loaded Q, caused by undercoupling. With manipulation and/or the addition of a matching device (such as a Transmatch), proper output coupling can be attained no matter how high the SWR. The transmitter doesn't "see" SWR at all. It sees an impedance resulting from an SWR.

9. Both coax and open wire feeders can radiate, though *not* to any significant level, by re-radiating energy coupled from the antenna due to feeder positioning, or by feeding a balanced antenna with unbalanced transmission line. Transmission line radiation has *no* relationship to the level of SWR.

10. Lowest feedline SWR occurs at the self-resonant frequency of the radiating element it feeds, *independent* of feedline length.

11. SWR *cannot* be adjusted or controlled in any practical manner by varying the transmission line length.

12. SWR indicators need *not* be placed at the feedline/antenna junction to obtain a more accurate measurement. The accuracy limits of the common SWR meters indicate that SWR at any point in the antenna system may be determined by simple calculation involving the SWR at the point of measurement, the transmission line attenuation per unit length, and the distance from the measured point to the desired point.

13. If the SWR readings change significantly when moving the SWR meter a few feet one way or the other, it indicates that some other problem exists and *not* that the SWR is varying with line length. The SWR bridge need *not* be placed at half-wave intervals to obtain a correct reading.

14. A dipole cut to be self-resonant at 3.75 MHz and fed with either RG 8/U or RG 11/U will not radiate significantly more at 3.75 MHz than at 3.5 or 4.0 MHz for feeder lengths up to 200 feet, providing proper loading can be attained.

15. With the use of a Transmatch or a simple L or T network at the line input, proper coupling can be attained over the entire band with *any* random length coax.

16. Changing the height of a dipole above ground or lowering the ends of a horizontal dipole to make an inverted V will have an insignificant effect on the amount of power reaching the antenna from the standpoint of attempting to reduce the transmission line loss due to SWR.

That's it! I hope this has been an elucidating series on antenna system impedances and how to match them.

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Microwave Test Equipment for 10 GHz

Several ways to use the detector mount

by C. L. Houghton WB6IGP

This article describes some of the test equipment which members of the San Diego Microwave Group use to make mountain-topping more enjoyable. The 10 GHz detector mount and its many uses are central to this project. You may be quite surprised by the variety of uses we came up with, and still more wait for your discovery!

I describe a detector amplifier that improves the operation of a remote coupled wavemeter for frequency tests and measurements. In a later article, I will cover the use of a backfire antenna detector, antenna bore sight indicator, and a method of injecting a two meter handheld into a 10 GHz transceiver and copying it, which allows for very accurate frequency measurements on 10 GHz.

The 10 GHz Detector Mount

The detector mount, the backbone of this project, is made from a short piece of 16 series waveguide measuring ½" by 1" on the outside, and 0.4" by 0.9" on the inside of the guide. You need only a short section of waveguide for each detector mount, which you can make quite easily from a discarded piece of waveguide (make sure it has flanges attached). This could be part of an attenuator assembly. You can build the flanges on each end of the attenuator into two detector mounts. Ease of construction depends on what you can find in surplus.

If the piece of waveguide you obtain is longer, you could place a three-screw tuner just ahead of the flange before the detector diode. This can tune out mismatches, thus improving mount efficiency. My mounts didn't need this, but yours may. The mount with a slide screw tuner would make a fine detector for your 10 GHz microwave receiver. This type of detector is normally used with a waveguide circulator or a polaplexer type of transceiver system. (See the article, "10 Gigahertz Polaplexer," in this issue.)

Detector Mount Construction

I cut off the section of WG-16 with a hacksaw, leaving a single flange and attached waveguide about 1¼" to 1½" long, then fit the waveguide with a piece of brass about 0.125" thick, the holder for the ground end of the 1N23 diode. Solder this piece of brass to the bottom of your waveguide (the 1" wide side), flush with the back end of the guide. File the back end of the guide flat and check with a carpenter's square to make it's true and flat. Spilt solder in the guide is quite lossy, and should be filed away.

Now drill a hole into the top and bottom piece of the guide through the brass stock you soldered on. This hole must be small, so use a 1/16" drill bit. Chuck the bit up in your drill so as to have just enough extending to go through both top and bottom in one motion, without the drill wobbling or going off true. This pilot hole is centered ¼-guide wavelength from the rear of the guide end opposite the flange. For 10.2 GHz, the ¼-guide wavelength is 0.378," 10.3 GHz is 0.371," and 10.4 GHz is 0.366." This is measured from the back end of the open waveguide to dead center in the waveguide face (on the 1" side). See Figure 1 for details.

The bottom end of the mount is drilled out to 15/64 and then opened up to accommodate a tight fit for the 1N23 diode. Do not go too fast or make the hole too large—a tight fit is necessary for a good ground connection. Drill out the top hole (now 1/16) to open it up for the top of the 1N23 diodes pin. I used a 7/64" bit. Open it up a little if you need to. Tap the diode with a 3-56 thread, or any thread on hand that will fit the top pin of the diode. Short the diode during this operation to prevent destruction from static discharges. Tin foil works well.

When a few threads have been cut, clean the device and place a small mica washer just under 1/4" in diameter over the top of the diode's pin. Next, insulate the pin. Cut a piece of Scotch tape and place it on a piece of glass, then trim your final section 0.080" wide, just long enough to go around the pin once. When the tape is in place, it will serve as a centering collar and insulate the pin from the top of the waveguide mount.

Fit the top part of the diode that extends from the waveguide, with a second mica washer, and place a small brass washer and ground clip with the nut to secure the entire assembly. Inspect the inside dimensions and remove any burrs that might have crept in to the operation, and which could possibly short out the diode and pierce the mica washers. I therefore recommend polishing with 400 grit

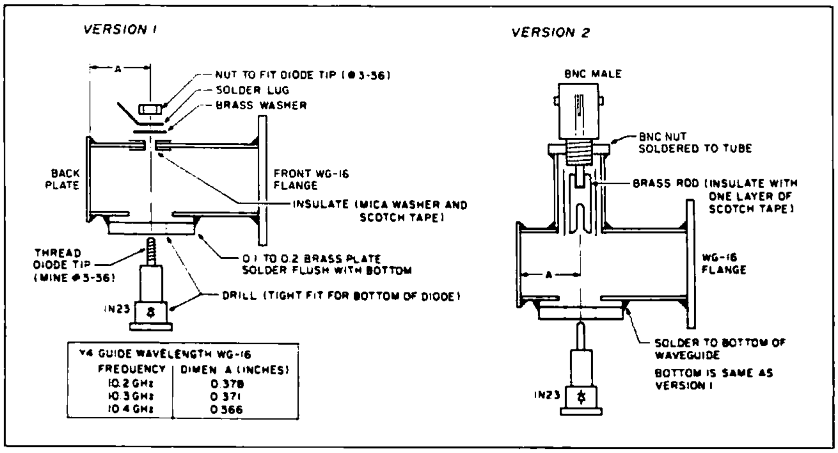


Figure 1. Two versions of the detector mount construction.

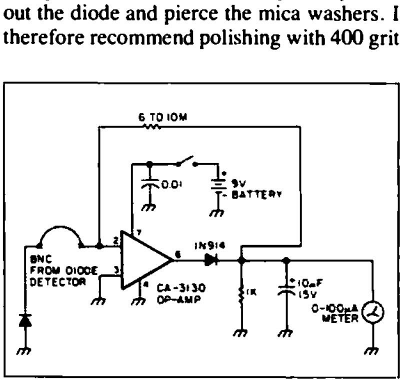


Figure 2. Detector amplifier schematic.

paper. If you are satisfied with the mount, remove all parts and solder a back plate on (with the diode removed).

When soldering, place the unit on the end plate and insert a small moist piece of paper towel to hold the side plate and prevent the solder from melting. Use a small amount of solder to attach the end plate. Keep heat to a minimum to prevent solder from flowing inside in the guide. Remove all excess solder and rosin, clean with alcohol, and assemble the diode on the mount itself.

You can make a mount as above, but with a different top section. It's a tricky soldering job, however. Drill a large hole in the top previously used for the top pin of the diode and fit in a short section of brass tube, which you then solder to the top of the waveguide. Next, you attach a BNC nut to the top of the tube and solder it firmly in place. Attach a short piece of brass rod, drilled to accept the BNC center pin on one end and the 1N23 diode tip on the other. When the assembly is insulated with a layer of Scotch tape, and inserted into the brass rod with the BNC nut attached, it will make contact and complete the mount. You will have to adjust the bottom spacer and the length of the brass tube so that the 1N23 diode pin makes contact with the brass rod that has been drilled to accept the 1N23 diode's pin. The rod should be nearly flush with the top of the waveguide. See Photo A for the pre-assembly and Photo B for the finished detector mount.

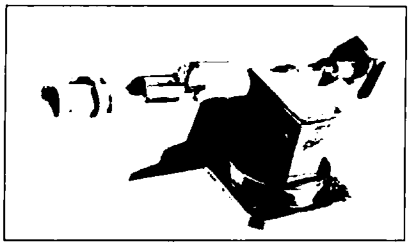


Photo A. Pre-assembly of detector mount with modified top section. Brass tube is soldered over the large hole on top of the waveguide. BNC nut is then soldered to the top of the brass tube.

Photo B. Fully assembled detector mount showing countersunk diode.

Photo C. 20 dB directional coupler CG-176 mounted between my Gunn oscillator and magnetic isolator. Forward (left) is the detector mount and the three-screw matching network.

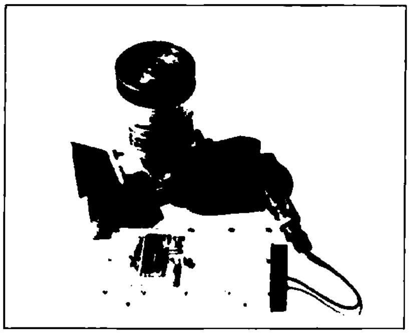


Photo D. Completed amplifier in metal box connected to wavemeter (FXR) with a very short coax cable.

Detector Mount Testing

When the detector mount is finished, check the diode with an ohmmeter for front-to-back ratio. Use the times 10 scale, since most diodes show about 5k reverse and 100 ohms forward. *Do not use the times 1 scale, because on some meters too much current can destroy or damage the diode.*

When you are ready to use the finished detector mount, connect a 100-microamp meter to the diode clip and ground, and turn on the Gunn diode oscillator. Hold the detector mount one or two feet from the antenna. You should have a reading on the meter showing relative power received. You can use the detector as a field strength meter to tune the Gunn oscillator and antenna to best match. By coupling a small horn antenna to the front of the diode mount, you can move further away and see the strength and pattern of your system. This is, in effect, a mini antenna test range. Credit for the detector mount with the threaded diode goes to the very fine *RSGB VHF/UHF Handbook*.

Detector Amplifier

By attaching a simple amplifier to the detector, and coupling an absorption wavemeter with a small horn antenna, you can go further away from your source and make frequency measurements. The detector and wavemeter has to be coupled very tightly to see the slight dip in power from the absorption wavemeter.

The amplifier was very useful in remote operation to check our frequency. Without it, we had to insert the wavemeter into the feed of our Gunn oscillator, which doubtless upset our measurements from the loading on the oscillator, large magnetic isolators notwithstanding. The amplifier on the wavemeter skirted this problem by allowing operation at some distance in front of, and just to the side of, the main lobe of the antenna. This made our frequency readings a bit more accurate.

Amp construction is straightforward. It is a simple single-stage current amplifier and peak detector rolled into one op amp. You can use the amplifier with either a commercial or the above home-brew detector mount with good results. The circuit was designed by my partner, Kerry Banke N6IZW, who selected the RCA CA-3130 because of its ability to work from a single 9 volt transistor radio battery. It works quite well. See Figure 2 for the circuit diagram.

Amp Operation

Enclose the entire amplifier and connecting cable in a tight RF-proof enclosure. This unit will be used on some high peaks where there may be much high power commercial operation. The RFI will influence your test equipment and can cause severe overloading to some two meter radios.

You can also enclose the entire back end of the detector mount in a small shielded box. This provides the best shielding.

Wavemeter Variations

We tried two variations of wavemeter setups, and each had advantages over the other. For the first, we attached a small horn antenna to one side of the wavemeter, and the detector mount to the other end. I then coupled the amplifier to the detector mount which allowed me to move about the front side of the dish antenna and obtain an on-scale reading without loading on the Gunn oscillator. With the higher meter reading, the dip at resonance with the wavemeter was now very easy to read and we could easily and confidently adjust our frequency on remote field outings. See Photo D, which shows the wavemeter and amplifier I use for remote readings.

The second method uses a 20 dB directional coupler inserted between the Gunn oscillator and the antenna, in front of the detector mount for the receiver. I bought the coupler, labelled CG-176-A, from a local surplus dealer for $7.50. The wavemeter, with horn removed, is fitted with a coax-to-waveguide adapter and connected to type "N" connecter on the coupler. Using the coupler, I can conveniently make frequency adjustments from the back of my dish. (See Photo C, Directional Coupler). This is much safer, since 150 mW of microwave energy going to a 30" dish giving 30 or so dB gain can cause bodily damage, especially to the eyes. BE CAREFUL!

Future Goodies

In a second article (to appear in *73* at a future date), I describe in detail the Backfire Antenna and the two meter injector. The two meter injector lets you set a frequency accurately by coupling an HT to your 10 GHz receiver.

I will make available high power Gunn diodes, case style 118 with silver brass rivets operating at 10 GHz, with measured power output of 50-100 mW, for $5 each, postpaid continental US. There are select, higher power devices available for 6 GHz, 10 GHz, and 18 GHz. (Power output varies from one cavity design to another.) I will gladly answer any questions regarding this or related projects. Please enclose an SASE for prompt reply. ■

73 Review *by Pete Putman KT2B*

Down East Microwave Model 2345LY

45 Element 23 cm Loop Yagi

Down East Microwave
Box 2310, RR #1
Troy, ME 04987
(207) 948-3741
Price Class: 2345LYK 23 cm Loop Yagi Kit: $82.00
2345LY Assembled and Tested: $99.00

The 23 centimeter band (1240–1300 MHz) is fast becoming the most accessible of the amateur microwave allocations, mainly due to the wide range of commercially-made equipment available. This includes several different antenna designs from both foreign and US manufacturers, ranging from loaded mobile/base whips, to "long-boom" designs for weak signal (SSB/CW) and ATV work.

The Down East Microwave 2345LY falls into the latter category, using 45 full-wave loop elements on a 15 wavelength boom to achieve nearly 20 dBi gain. The design is based on the classic loop yagi pioneered by G3JVL many years ago, and loop yagis have found wide acceptance from 903 to 3456 MHz since. Down East's literature claims that "...four 23 cm 45 element 'loopers' compare favorably in gain to a 7-foot dish, with much less wind resistance." Not only that, but four loop yagis are considerably easier to install on a frame and use with a rotator than a dish.

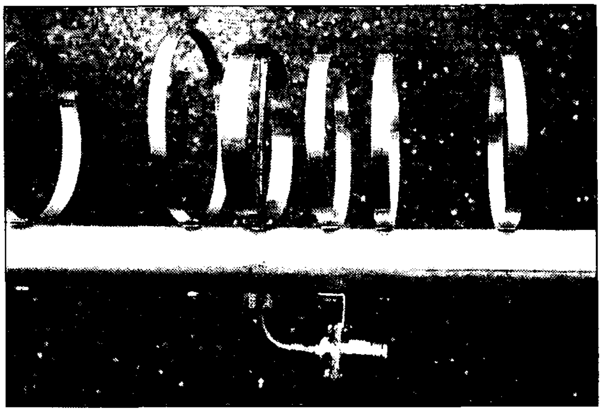


Photo A. This view shows how the driven element is fed, using UT-141 rigid coax line. The loop is a full wave at 23 cm. Input impedance is 50Ω.

Check Out The Parts

I selected the "K" (kit) version for this review. 2345LY construction is quite simple, although there are several bags of parts to contend with. I suggest you first sort all of the hardware into four or five piles. Down East ships a small package of 4-40 stainless screws, lockwashers, and nuts that are used to secure all 45 elements to the boom. Sort these into three piles for quicker assembly. 8-32 nuts, lockwashers, and bolts are also included for the boom-to-mast clamp assembly, and these can be set to one side.

Assembly

Only one tool is really needed for 95% of the assembly work. Use either a ¼" wrench, or, better yet, a ¼" socket drive/spintite. There are 7 sealed bags containing like elements, and each is clearly labelled. Don't open the next bag until you are finished with the prior one, otherwise you may mix up the parts, causing great confusion! The differences in circumference between element #D23 and #D24 is just 0.101 inches, so a mistake there would be hard to find and correct.

It's best to install the elements from the rear forward. The lockwashers allow quick tightening, but make sure the ends of each loop don't flex inward or outward. Holding the loop while spinning the socket drive will prevent this. Tighten the loops as snugly as possible to avoid misalignment from light bumps or incidental contacts as the antenna is installed.

As with all Down East loop designs, two reflectors are used. Unlike the 33 cm and 13 cm versions (reviewed earlier this year), the two are of different width aluminum stock. The driven element is fashioned from brass strip and tubing, with predrilled holes for the UT-141 coaxial feeder.

Photo A shows the position of the driven element relative to the reflectors and first director. Down East supplies a pre-cut piece of UT-141 cable soldered to a flange-mount N connector. This cable is inserted through the tubing end of the driven element and soldered to the top. Be careful to align the N connector with respect to the boom before soldering the coax! The reason for this action is that the connector and flange will be bent forward to attach under Director #1, with the connector facing the front of the boom. Be sure to flow solder evenly around the shield of the rigid coax line where it attaches to the driven element.

The two boom sections attach using the hardware from elements #D22 and #D23, allowing quick break-down for transporting the yagi. The boom-to-mast assembly consists of two pieces: (1) A machined piece of ½" square tubing and (2) A mast plate with hardware. The tubing fastens to the boom with two 8-32 screws, washers, and nuts. The plate attaches at a right angle with two more 8-32 screws, and the entire assembly can then be bolted to a mast.

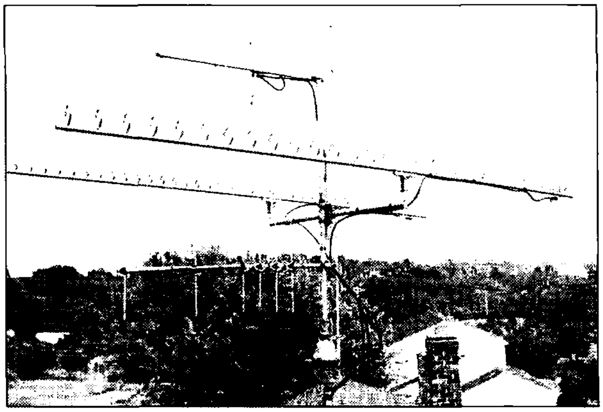


Photo B. The 2345LYK in service (rear) and Down East 3333LYK is front. They make a nice pair for microwave operation!

The only catch here is that Down East supplies U-bolts for 1" diameter mast stock! If using a larger material, a hole will need to be drilled on to the plate accordingly. Probably the reason(s) this size was arrived at are the accessory stacking frames for two or four "loopers," that use 1" stubs with 2" bolts to make the mast connection. Evidently, Down East expects to sell lots of these in pairs! Keep in mind that the 2345LY (like the 33 cm and 13 cm versions) must be mounted above any mast. If the mast protruded into the loop area, it would seriously detune the antenna.

Technical Data for the Down East Microwave 2345LY

Specification	Rating
Frequency Range:	1.25 to 1.3 GHz
Number of Elements:	45
Boom length:	143 inches (15.7 wavelengths @ 1296.000 MHz)
Weight:	5 pounds
Gain: (3 dB Beamwidth, E-plane)	> 20 dB
Maximum Power Capacity:	550 watts average
VSWR: (measured with Bird 43 and 25K slug @ 1296.100 MHz)	1.05:1

Photo B shows the 2345LY installed on my "solution" to the 1" mast clamps–a custom-welded trident assembly with 1" stubs at either end. (This might be a neat thing for Down East to add to their catalog!) This system allows the use of two separate loopers anywhere along a 1½" to 2" mast. It is also used when I go portable on 903 and 1296. The 2345LY is to the right, with the 3333LYK to the left. The load is sufficient for a garden-variety CD45II rotor to turn without much sweat.

Observations

How does it work? Very well! The pattern of the 2345 is not quite as sharp as my Tonna 55 element yagi, but in everyday use with a transceiver (such as the IC-1271A) or transverter (such as the LT-23S), there was little noticeable difference. Communications were possible from this location to Baltimore, southern New Jersey, and into Massachusetts, using an outboard 60 watt amplifier. It will be interesting to see how the circular polarization obtained from the use of a loop element minimizes "multipath" signals from nearby hills and obstructions.

One advantage of the 2345LY is the absence of a boom brace. The 1" diameter tubing used for the boom, is rigid enough that "sag" isn't evident. Matching was a breeze: Down East suggests bending the driven element to 2.75 inches high for best match. However, I merely soldered the UT-141 cable to the driven element and made no attempt to adjust the height. As the table shows, virtually no reflected power was detected.

Another advantage that "looper" fans are quick to point out is that raindrops and condensation droplets fall to the mounting point of the antenna, minimizing detuning effects that can drive conventional half-wave elements out of resonance. This is certainly true, but note also that heavy, wet snow tends to pack up in loop elements.

Regardless, the Down East Microwave 2345LY is an exceptional value in a high-gain, lightweight yagi for general 23 cm work. Note that the 2345 is also available assembled and tested, but the kit version is easier to ship. Construction is simple and the materials are of high-quality T60-6 aluminum stock with stainless hardware. It should find favor not just with SSB and CW types, but also ATV, packet, and FM operators. ■

Number 17 on your Feedback card

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B
3335 Fieldstone Dr.
Doylestown, PA 18901

FN27...Yet Again!(Part 2)

The bulk of the assembly work went fairly quickly on Friday. The weather was excellent (in stark contrast to 1987) with temperatures in the 80s and a light breeze blowing. Many of the antennas had been assembled beforehand and partially broken down for transit. It was a simple matter to get the two meter station up and running in short order. The H-frames fell together beautifully, and the skyline soon filled with 70 feet of tower and 68 elements-worth of yagis!

Ivars and the two Toms set about constructing the UHF/SHF tower. They had to find some way to cram 536 elements onto an 18-foot mast atop the W51 tower trailer! It took nearly all day to do it, but the resulting configuration was worth the effort. It looked like an abstract sculpture! Meanwhile, Steve and Bill assembled the four 6-meter beams in jig time to discover that the rotor atop the W-67 was defunct! Murphy had finally arrived!

Rich arrived about 3 PM with the station tents—brand-new Hillary models he picked up on the way in. The dome design let a lot of light in during the daytime, and was just big enough to accommodate the 7-foot tables laden with equipment. The 6 meter rotor was fixed, and I removed three Honda generators from my pickup—one for each station. Two were 5000-watt units and the remaining unit a 4000-watt model, so we had a fair amount of power on tap. By 6 PM, every station was on the air and percolating nicely, so we took it easy the rest of the night.

Final Moment Draws Near

Saturday found us increasingly tense as 2 PM neared. Would it all work? Would it continue to work? We had our answer right away, as the keying relay failed immediately on 6 meters! Output was low on 2 meters for some strange reason, and the 220 kilowatt was running unsteadily. Oh well. another typical June contest! I did something I'd never done before, and started out on 432 SSB running 250 watts.

Within the next hour, the 6 meter relay problem was solved and we burst onto the band with a vengeance! The 2 meter amplifier was finally retuned, and with the aid of an intermediate amplifier, we were seeing 1500 watts output. Tom Richmond and Tom Hodge spent quite some time tweaking the 220 station, but managed to coax about 1 kW output from it as things stabilized.

What a joy to have separate rotors! I was surprised at the amount of activity on 70 cm early on, and began piling up grid squares. In fact, the first 12 contacts were each made with a different grid! We were definitely being heard on 432. 220 was also enjoying some early activity as the sought-after "Fox Nancy Twenty-Seven" report was given over and over.

Shortly after, Murphy struck again. The 220 station began keying the RF VOX line on the THL250U, which resulted in some high speed data bursts on 70 cm instead of clean CW. Turning on the GaAsFET preamp alleviated the problem, but the 220 signal was "pumping" the front end on 432. Out came the 5-year-old Mirage D1010, and we made do with 130 watts for a while.

Over on 6 meters, the operators managed to go through 3 transverters and 4 preamplifiers while maintaining an excellent QSO rate! Six was opening in all directions except Europe, and our gamble with the four 5-element yagis was paying off in spades. It began to look like we might actually approach last year's total of 204 grids. 2 meters was also enjoying reasonable success, as many rare grids were picked off to the west and south.

Many stations were worked on 903 and 1296 during the activity hours that evening and Sunday morning. However, Murphy also took a swipe at the 2304 station, causing a problem with receiver sensitivity that I was not able to resolve. We were barely able to hear the Rover station in nearby FM28—only 4 miles to the north! It was heartbreaking to know we were heard in FN21, FN20, and FN30, but couldn't reciprocate.

Tom Hodge pulled out his microwave equipment, and we set about making a few Rover contacts on 2304, 3500, and 10,000 MHz. FM27 was easy, as we were about 100 feet apart and knocked off the OSOs in short order. A foray in the car and some nosing around resulted in a somewhat mucky but appropriate path back from FM28 on the three bands. We weren't ambitious enough to drive 40 miles south to FM26, though. Many local operators gave us contacts on 220 and 2 meter FM, following up with a visit to the site to ogle the tower trailers.

> *"The tropo enhancement at night was truly spectacular."*

The tropo enhancement at night was truly spectacular. Stations that were barely 6 dB out of the noise on 1296 were 60 dB stronger at 9 PM! I found myself ragchewing with stations in Long Island, New York, and southern New Jersey on both 903 and 1296, enjoying armchair copy. Even stations along Chesapeake Bay were booming in from Baltimore and points west. If only more stations had gotten on then and taken advantage of it!

Things drew to a close all too soon as the 2304 station went up in smoke, six meters blew another transverter, and the two meter intermediate amplifier kicked the bucket. Fortunately, the antenna rotors held up as we were blessed with light winds all weekend long. I spent the last 10 minutes of the contest trying to work K1TR in FN42 (made it) and we knocked off contacts with north central Ohio on both 2 and 432. The six meter guys made a last, frantic sweep through an opening into Arkansas and the southwest before throwing in the towel.

I had been keeping track of all the contacts on my AMQ portable PC inside Bill's trailer, and was able to come up with a reasonably clean log about half an hour after the contest ended. There was no doubt we bettered our 1987 score—we made over 100 more contacts with far fewer six and two meter openings. The final tally:

Band	QSOs	Grids
50	431	161
144	331	52
220	67	26
432	83	31
903	11	6
1296	35	13
2304	2	2
3500	2	2
10000	2	2

The total was 964 QSOs and 295 grids for 361,080 points. In 1987, we had made 846 QSOs and worked 313 grids (mostly on six) for 330,000 points, so our objective of bettering our score had been achieved. The goal was for 1,000 QSOs and 300 grids...we came darn close! In fact, the only band showing little improvement from 1987 was 432, where we actually worked eight less QSOs but three more grids. It's hard to imagine making more than 1000 contacts from an area as remote as Chincoteague without some incredible band conditions from six meters right on up to the microwave bands.

Kudos

Many people donated time, energy, and equipment to make this effort successful, and I'd like to thank them for it: Deb Davis from ICOM for the '75 series multimodes, Donna Irby from Encomm for allowing their prototype UHF amp to be beta-tested, Everett Gracey of RF Concepts for an RFC 3-312 which performed flawlessly driving the 8877 on 220, The PX Shack for supplying all of the F9FT Tonna antennas, Mike Crawford WA2VUN for his generator, and all of the custom antenna support fabrication; Bill Olson W3HQT for his help in debugging the LMW 13 cm transverter, Dave Mascaro WA3JUF for retuning the 13 cm amp at the last minute, Joel Knoblock of the RF Connection for providing a sample of their new 9913 cable for 432 MHz, and, most of all, Jim Thompson, Secretary of the Curtis Merritt Harbor Committee for his assistance in getting permission to use the site in the first place!

I'll follow up on some of the equipment performance in future columns. See you in November...Above and Beyond!

Number 18 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore, MD 21208

BASIC RTTY

September, the thoughts that it stirs are profound indeed. For the child, a return to school. For the parents, their child's return to school! Hmmm . . . I think I found a congruence there. Anyway, whether back to school or back to basics, this time of year is just right for looking at a letter I recently received.

Stan Rutherford WØEUG in W. Des Moines, Iowa, is interested in getting onto, as he puts it, "Just plain RTTY; no packet, no AMTOR or any other of that space age stuff." He has an HF transceiver and simple computer (C-64), and wants to know what else he needs.

Well, Stan, you already have the kernel of a very capable RTTY station. Your transceiver is modern and quite capable of SSB operation, which correlates with a good capacity for RTTY as well. The computer can serve as the "glass terminal" for the station. All that you need is a way to convert the computer-standard ASCII, used by the computer, to RTTY-standard Murray, used on the air. There are *at least* three ways to do this.

The cheapest way is to secure a program to enable the C-64 to operate on RTTY directly, either alone or with a simple, one-chip demodulator. I am not aware of any software packages for the C-64 for this purpose, as I am for the TRS-80 CoCo, but I do not doubt that they exist. (Three days after the publication of this article I will receive notice of no fewer than eight of them!)

Converting the audio output of your receiver to the voltage blips your computer uses may require a hardware device variously referred to as a "TU" (Terminal Unit), Demodulator, or RTTY Interface. Staying cheap for a second, designs for a one-chip version have been covered here in RTTY Loop in the past, and are adequate for strong signal work or VHF, where noise is not a problem.

Transmitting at this level can take several avenues. If the computer is capable of putting out a clean sine wave, that tone itself, properly shifted and encoded, can be used to key the transmitter. Otherwise, another one-chip card can be put together to convert TTL signals to audio tones. As with the demodulator, simple one-chip AFSK generators have been detailed in past issues of RTTY Loop.

The next step up, in cost if nothing else, would find you using a hardware card to plug into the C-64 to operate on RTTY. These are available from several sources. Check the ads here in *73*. Back issues may also prove fruitful, as manufacturers seem intent on adding the latest features (and costs), rather than keeping a product simple and cheap.

And, finally, there is the dedicated RTTY interface box. Ranging from simple converters to elegant multi-mode wonders, these little LED-encrusted bricks make operating on RTTY little more trouble than calling up the local bulletin board system.

Of course, if you get such a multi-media wonder, it might not be long before you wonder just what that PKT or ARQ light is all about. You might very well find that some of the "space age stuff" isn't all that exotic, after all!

RTTY on the CoCo

Malcolm Hall KE5OK, in McGehee, Arkansas, is another beginner. Malcolm has a TRS-80 Color Computer II, and wants to put it onto RTTY, again as simply as possible. He notes that when he turns the computer on, the screen reads "COLOR BASIC 1.2 (C) 1982 TANDY," and wonders about the capabilities of this machine.

In an all too familiar plight, Malcolm relates going to the local Radio Shack, asking about RTTY for the CoCo, and they did not even know what he was talking about.

He also notes that, while he has seen some programs published for RTTY, they were for different machines and "the commands are different from mine."

Well, to begin with, Malcolm, the machine you possess is equipped with Color BASIC, the simplest BASIC to come on a CoCo. BASIC is, however, far too slow on the CoCo, or most machines for that matter, to be used in the conversion of ASCII to RTTY. While using machine language may seem to be an obstacle to you, it really can work to your advantage.

By using a program written in machine language, the language directly understood by the CPU of your computer, you are freed from the restraints placed upon the system by the resident version of BASIC. Such programs have been written for the CoCo, the most recent of which was published in the January 1988 issue of RTTY Loop. If you can't get a copy locally, send me a tape or disk, with $2 and a stamped, self-addressed mailer, and I will be happy to send you a copy of the program.

On another note, Malcolm asks whether he needs a printer, or if the video screen will suffice. Again, it depends on what you want to do. For simple ragchews, I can't see any more need to produce a paper copy of a RTTY QSO than to make a transcript of the conversation I had on the 2 meter repeater this afternoon. If, on the other hand, you are handling messages, or are into RTTY pictures, then a printer becomes essential. Almost any printer will do.

Not all beginners use simple computers. H. Jack Meadows WD7I of Mesa, Arizona, notes that he has been inactive on RTTY for ten years, since giving away his Model 19, and that things certainly have changed. He wonders what it would take to put his Macintosh SE computer onto RTTY, and suggests an AEA PK-232 "plus what?"

How about a cable and modem program, Jack? That's about all it would take with this class of "smart demodulator." Talking to any of these upper level TUs is really little different than talking to a telephone modem. As we discussed last month, a dedicated program, such as the kind published for the PC clones, does make life easier, but it is not absolutely necessary. I think whatever communications program you have would be an excellent starting point. Then again, I may very well hear of a specific PK-232 -> Mac interface shortly after this column sees the light of day!

In Search Of. . . .

Every once in a while someone drops me a note in which he or she tries to enlist my aid in search of something or other in the RTTY field. Occasionally, I have even heard of the item being sought. Bingo for this one.

Charles Gelsinger of Albuquerque, New Mexico, has been looking for two TTY re-inkers that were used, he believes, on Models 15 and 19. He describes a very small unit, about one by two inches, which was mounted in the ribbon path to keep the ribbon freshly inked.

Emerson Cyrus 8P6QA writes from Barbados of his interest in a CW program in addition to the RTTY program for the Color Computer. Well, Emerson, I have not seen a public domain or shareware CW program for the CoCo, yet. There are several RTTY programs, several of which have been featured in this column, and a few commercial CW programs, but I have seen nothing from the noncommercial sector.

I have received more than a few questions for such an animal. Does anyone know of a true CW program, as opposed to just a Morse tutor? Let me know, okay?

Dr. James Kretzschmar N4HCJ of Davis, California, is interested in receiving commercial RTTY, such as from the news services. He wonders if there is any way to do this "without involving the purchase of a computer."

Sure. Go out and purchase a commercial RTTY receiving setup. Otherwise, you are going to have to deal with the fact that commercial stations use a variety of shifts, speeds, and codes which render them far different in many respects from ordinary amateur RTTY.

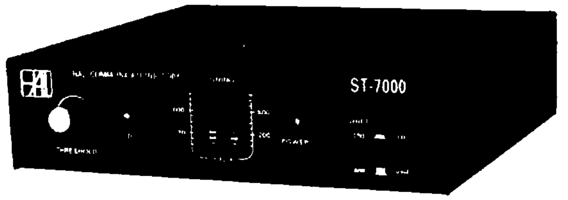
But, assuming you are not rich enough to afford a commercial demodulator, even though the commercial units use them as well, you are going to have to bite the bullet and get a computer. Now, this can be a dedicated computerized interface, such as the popular AEA PK-232, or a big commercial terminal. I think you will find that a unit such as the PK-232 will decode about anything up to a certain level.

To control the interface you will need some sort of terminal, which may be just that—a dumb terminal—or an inexpensive computer, such as a simple CoCo or C-64, running a terminal program. For output or hard copy from the setup, about any printer will do. It's going to cost you about $500 for a setup like this, or perhaps a tad more (not including receiver), but it should be worth it. Let me know how things turn out.

Number 19 on your Feedback card

NEW PRODUCTS

Compiled by Linda Reneau



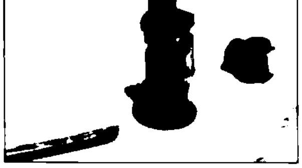
PRODUCT OF THE MONTH

HAL COMMUNICATION CORP.

Hal Communications Corp., is proud to announce the new ST-7000 HF Packet Modem. The ST-7000 was designed specifically for 300 baud HF packet. Included is an AGC-controlled AM signal processing, a tuning indicator, and a choice between the standard 200 Hz shift mode or 600 Hz shift mode. Both are fully supported by separate optimized 6-pole input filters, and a 40 dB AGC system. The standard 200 Hz shift mode uses phase-locked loop (PLL) detector, whereas the 600 Hz shift mode uses separate 4-pole Mark/Space filters, active detectors, and a 3-pole post-detection filter. The transmit tone generator uses a crystal-based 10-step sine-wave synthesizer circuit. The ST-7000 interfaces to any existing packet TNC via RS-232C, TTL, or TNC audio tones. The ST-7000 is available for $299, including wall-mount power supply. For more information contact *HAL Communications Corp., PO Box 365, Urbana IL 61801; 217-367-7373*, or circle Reader Service number 210.

ICOM

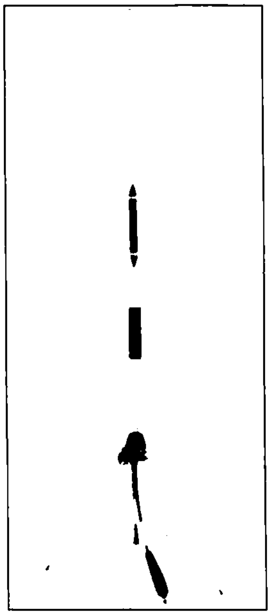
ICOM introduces the IC-3210 25 watt, 2 meter and 440 MHz dual band mobile transceiver, with full duplex operation and wideband coverage. It has 20 memory channels for two meters and 70 cm, which store all relevant information. The Programmed scan function scans all memory channels or lock-out channels in the memory sequence. Priority Watch monitors the call channel every five seconds while operating on another frequency. Price: $739. For further specifications, contact *ICOM America, Inc., at 206-454-8155.* Or circle Reader Service number 201.



EDMUND SCIENTIFIC COMPANY

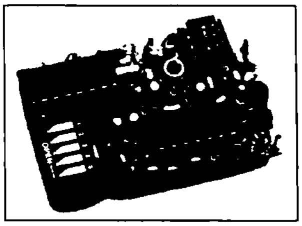
Edmund Scientific Company's 3-inch torch features a piezo-electric ignition system, two flame levels (800°C to 1300°C), and uses butane gas. It solders, brazes, and sweats, and can be used for melting, shaping, fusing plastics, or thawing frozen locks. The torch comes with a stand for free-standing use. The price is $39.95 plus $2.50 postage. Order from *Edmund Scientific Company, 5552 Edscorp Bldg., Barrington NJ 08007.* Or for more information circle Reader Service number 211.

THE ANTENNA SPECIALISTS CO.

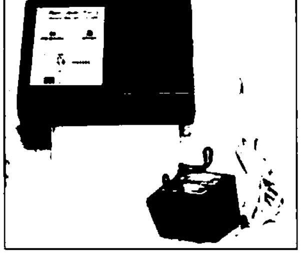


All-band scanner antennas that provide enhanced performance up to 1000 MHz are now available from The Antenna Specialists Company. Models MON-52 (mobile) and MON-58 (base station) feature MICRO-CHOKE™, which gives pinpoint resonance at 800 MHz scanning frequencies and concentrated beam focus at low radiation angles for maximum range monitoring. Scanners can pick up police and emergency communications These all-band antennas offer coverage from 25–1000 MHz at low and high VHF and UHF bands. The mobile version has a no-holes, "Quick Grip" trunk lid mount and coax cable with installed pin plug and sells for $52.50. The base station antenna has an easy one-clamp installation and sells for $42.95. For more information, contact *The Antenna Specialists Co., 30500 Bruce Industrial Parkway, Cleveland OH 44139-3996; 216-349-8400.* Or circle Reader Service number 209.

COMMUNICATIONS SPECIALISTS, INC.



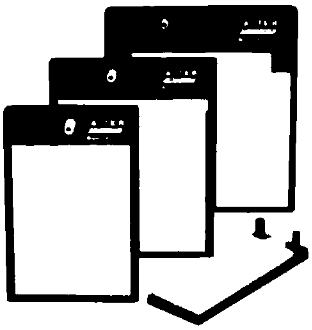
The TS-32P Programmable CTCSS Encoder-Decoder is now available from Communications Specialists. It has all the features of their TS-32, but uses a new microcircuit, the IC-110, for tone versatility. The IC-110 contains a 32-bit reprogrammable memory which allows the shop to specify any 32-tone frequencies from 15 Hz to 255 Hz. The TS-32P can be configured to provide multi-tone switching of up to six tones, without requiring diode networks. There is also easy access to any non-standard tone frequency. The 32-location tone memory can be changed in the service shop with a handheld programmer available from Communications Specialists or by returning it to the factory for re-programming at no charge. The TS-32P operates on 6 to 25V DC. Price, $57.95. *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; 800-854-0547 or 714-998-3021. Circle Reader Service number 203 for more information.*



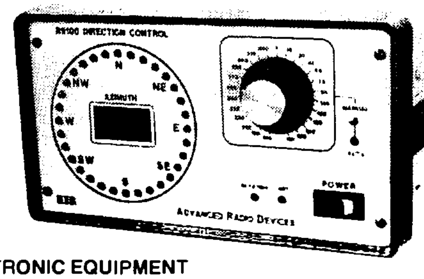
ELECTRON PROCESSING, INC.

Electron Processing, Inc. has added the Tape-Saver TS-1 to their line of SWL and scanner accessories. It provides scanner owners with a way of connecting their cassette recorder to the scanner so that they won't waste recording tape during periods of scanner inactivity. The Tape Saver TS-1 automatically switches the cassette recorder on and off by means of the remote control jack on the user-supplied recorder. Connect the Tape-Saver TS-1 to the scanner and tape recorder via standard mini plugs. A submini plug connects to the recorder for ON/OFF control. Pricing starts at $49.95 with quantity discounts. Contact *Electron Processing, Inc., Sales Department, PO Box 708, Medford NY 11763; 516-764-9798.* Or circle Reader Service number 208 for more information.

DAVLE TECH INC.



New solderless circuit board kits are available from Davle Tech Inc for the electronic technician, lab technician or hobbyist. Distance between the tie-point contact clip is 2.5mm (0.1"). They can accept all components with leads or solid wire AWG 22–30 (0.3–0.8mm) and accept all DIP sizes. The contacts are made of precision formed nickel, silver, or gold plated contact material, highly conductive, with the initial contact resistance less than 1 milliohm at 1 kHz. Models include the B-147-N for $52.50, B-147-G for $84, B-124-N for $27, B-124-G for $42, B-112A-N for $16, B-112A-G for $19.20, B-64D-N for $290, and the B-64D-G for $390. Contact *Davle Tech Inc., 2-05 Banta Place, Fair Lawn, NJ 07410; 201-796-1720.* For more information circle Reader Service number 206.



ELECTRONIC EQUIPMENT BANK

The R9100 heavy duty antenna rotator from Advanced Radio Devices is available from EEB. The R9100 has 10,000 in.-lbs. of torque, 23,000 in.-lbs. braking, and will support a 2000 lb. vertical load. The unit fits inside the Rohn 45 tower and weighs 230 pounds. The control unit provides both analog and digital displays, manual control, and an RS-232 interface for external computer control. Software is provided. Suggested list price is $3,975. For more information contact *Electronic Equipment Bank, 516 Mill St., Vienna VA 22180; 800-368-3270 or 703-938-3350.* Or circle Reader Service number 212.

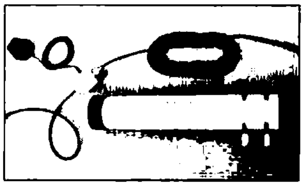
RAPID SYSTEMS, INC.

Rapid Systems announces their new R3200 logic analyzer peripheral for PCs. It has eight channels at 100 MHz or 16 channels at 50 MHz or 24 channels at 25 MHz, for flexibility in digital testing and analysis. The R3200 features 8K per channel memory, using eight channels, waveform zooming, store/retrieve/print waveforms, timing and state analysis, internal sample and reference memories, and advanced triggering using AND, OR, or NOT.

No programming skills are required. Connect the R3200 to the PC bus with the supplied interface card, and run the software. The hardware, connection probes, software, and user manuals are priced at $1,995. *Rapid Systems, Inc., 433 N. 34th St., Seattle WA 98103. 206-547-8311.* For more information circle Reader Service number 213.

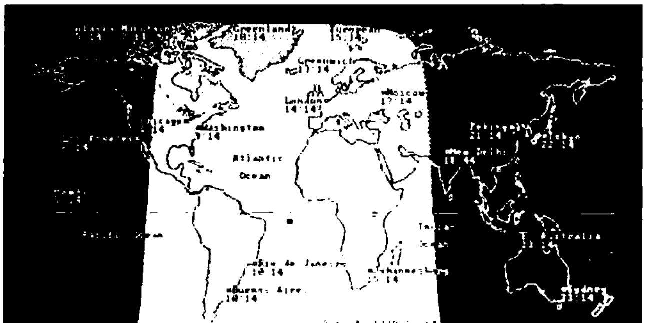
GILFER ASSOCIATES, INC.

The Dressler ARA 900 is a VHF/UHF active receiving antenna, capable of capturing signals from 50–900 MHz. The ARA 900 cylinder contains a wideband amplifier, and an impedance matching network. It can be mounted indoors or outdoors. The supplied lead-in coax is 25 feet long and can be replaced if desired, by any length coax with PL-259 fittings up to 100 feet. The coupler terminates in an N-type connector, fitting the top of the line scanners, such as the ICOM R-7000 receiver. Price: $189 (includes power adaptor) plus $8 S&H. Distributed by *Gilfer Shortwave, 52 Park Avenue, Park Ridge NJ 07656; 201-391-7887.* Circle Reader Service number 205 for more information.



KENWOOD

Kenwood's TH-55AT 1200 MHz Pocket Transceiver has a frequency coverage of 1258–1300 MHz, an easy-to-read LCD display, and tone alert monitoring system built in. It uses the same accessories as the TH-25AT Series HTs, except for frequency-related items, such as antennas. Its 14 memory channels store frequency, repeater offsets, subtone frequencies, CTCSS and reverse information. Two of the memory channels store transmit and receive frequencies independently, allowing operation on repeaters with both standard and odd offsets. Other features include frequency lock switch, memory recall, memory shift, memory and band scan, auto power-off function, and programmable CTCSS tone encoder/decoder. Suggested retail price, $499.95. *Kenwood USA Corporation, 2201 E. Dominguez Street, Long Beach CA 90810; 213-639-4200.*



MFJ ENTERPRISES, INC.

The MFJ-1286 Gray Line DX Advantage/Terminator is a computerized DXing tool for IBM PC/XT/AT and compatibles. It gives users instant access to Gray Line positions for any place in the world, at any time and date from 1980 to 1999. A high resolution map displays the moving Gray Line, UTC times, time zones, sun position, and latitude/longitude markers. It corrects the north/south position of the sun and the earth's curvature, and features a high speed display mode with pause. The DX Advantage can run by itself or in conjunction with other software, including graphics. The DX Advantage can also be customized to suit your DXing needs. Price, $29.95. Contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State, MS 39762. 601-323-5869. Order at 800-647-1800.* Or circle Reader Service number 202.

73 Review *by Ray Weber KA1JJN*

Motron Auto Kall Model AK-10

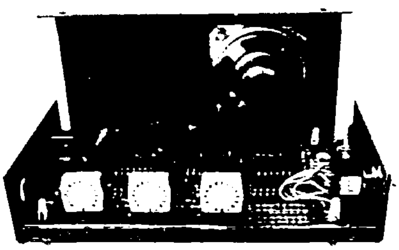
A way to beat busy repeater chatter.

Motron Electronics
695 21st Ave.
Eugene, OR 97405
(503) 687-2118
Price Class: $90

Here's a device almost anyone can find a use for. The AK-10 attaches to any FM receiver and decodes touch tones to activate both an LED indicator and a speaker output. It has built-in switches that set it up to decode any 3 digit touch-tone code, including A through C.

The unit is in a small 5½" by 3" by 1¼" case and includes an external AC power supply and audio patch cord.

The unit performed amazingly well with low quieting signals. It took about 50% quieting for reliable operation. It operated well on 12 volts DC, and with the included AC supply.



The AK-10 uses an SSI-202P tone decoder chip to provide crystal-controlled, reliable decoding. This chip is known for its excellent performance, and exhibited it in this test. It reset when getting a wrong signal and did not false. Low power CMOS chips are used throughout for minimal current consumption.

The AK-10 connects to the speaker audio and provides an internal speaker that is activated when the proper tones are received. The decoder can be bypassed with a front panel switch.

The unit resets automatically after being tripped, but leaves the front panel LED lit to indicate that it received a signal.

This unit is an ideal device for anyone that wants to receive messages on FM without constantly hearing on-channel traffic. It is perfect for emergency personnel activation—or hearing calls just from friends!

SPECIAL EVENTS

Ham Doings Across the Country

HUNTINGTON WV
OCT 1

The Tri-State Amateur Radio Association, Inc., is sponsoring the T.A.R.A. Hamfest '88 and Computer Fair at the Huntington Civic Center, from 9 AM to 4 PM. Admission, $4. Forums, VE testing, giant flea market, dealers, all indoors. No stairs for handicapped. Talk-in, 146.16/.76. Contact *Charley Shumaker N8IKP, PO Box 4120, Huntington WV 25729; 304-523-5264.*

WARRINGTON PA
OCT 1-2

Mt. Airy VHF ARC, the Pack Rats, invite all amateurs and friends to the 12th Annual Mid-Atlantic VHF Conference on Oct. 1, and to the 17th Annual Hamarama on Oct 2. Advance registration for the conference is $5, $6 at door. This includes admission to the flea market. Flea market only is $4, $7 per carload. Selling spaces, $6 each. Gate opens at 6 AM; bring your own tables. Send payment to *Hamarama '88, PO Box 311, Southhampton PA 18966. Contact Pat Cawthorne WB3DNI, at 215-672-5289.*

WICHITA KS
OCT 1-2

The Wichita ARC will host the annual ARRL Kansas convention at the Red Coach Inn. Doors open at 9 AM, admission $5 pre-registered, $6 at door. Huge indoor flea market, commercial displays, technical seminars, meetings, banquets, prizes, Wouff Hong ceremony, entertainment. Talk-in on 146.82 for out-of-town hams, 146.94 for local hams. For advance registration, contact *Vern Heinsohn WAØZWW, 950 Back Bay, Wichita KS 67203.*

BENTON HARBOR MI
OCT 2

The 1988 "Blossomland Blast" will be from 8 AM to 4 PM at Lake Michigan College. I-94 Exit 30, East to Yore Road, North to entrance. For info, write *"Blast," PO Box 175, St. Joseph MI 49085.*

HAMMOND IN
OCT 2

The Lake County ARC is sponsoring its 16th annual Hamfest at the Hammond National Guard Armory. Limited tables, $5 each. Admission, $3.50. Set up, 6 AM. VE testing. ARRL, ARES, MARS information available. Talk-in on the Lake County ARC repeater 147 or 146.52 simplex. Contact *Lucy Schendera N9DTG, 812 E. 40th Place, Griffith, IN 46319; 219-923-4873.*

ROCKFORD IL
OCT 2

The ARRL Illinois State Convention will be held in conjunction with the Rockford Hamfest-88/ Computer Fair from 9 AM to 4 PM at the National Guard Armory. ARRL forum, ham and computer talks, technical demonstrations, commercial exhibits, large flea market (tables $7 in advance, $10 at door), and VE exams. Tickets $3 in advance, $4 at door. Talk-in on 146.01/.61, 223.68/224.28, and 146.52 simplex. For seller information, contact *Roger Sawvell KD9MQ at 815-633-0520*. For general info, *Jim Miller W4JR, at 815-397-4602*. Send SASE for reservations to *Rockford Hamfest, PO Box 10003, Rockford IL 61131.*

ROME GA
OCT 2

The Rome hamfest, sponsored by the Coosa Valley ARC, Inc., will be at the Rome Civic Center. Admission, free. Inside tables, $6; outside spaces, $2. Homemade Bar-B-Q and stew, camper parking, no hookups. VE exams, drawings, bingo, contests, prizes. Reservations requested, walk-ins OK. Contact *James WD4JHF or Linda WD4JHG Sineath, 1124 New Rosedale Rd., NE Armuchee, GA 30105; 404-291-9767.*

SPRINGFIELD OH
OCT 2

The Independent Radio Association will hold the 6th Annual Springfield Hamfest and Computer Expo at the Clark County Fairgrounds from 8 AM to 4 PM. All vendor and swap-meet activities indoors. Admission, $3 (advance, $2). Tables, $7 (advance, $6). Talk-in on 145.45 and 224.26 MHz. Write the *Independent Radio Association, PO Box 523, Springfield OH 45501* or call *Gary WB8YUC at 513-399-4732.*

ST. CHARLES MO
OCT 2

St. Peters ARC's 4th Annual Swapfest will be in McNair Park Day Care Center from 6 AM to 2 PM. Admission $1 to buy or sell. Door prizes. Talk-in on 145.41 repeater and 146.52 simplex. Call *Allen Underdown at 314-723-4200.*

WEST LIBERTY IA
OCT 2

The Muscatine and Iowa City ARC is having their Southeast Iowa Hamfest at the West Liberty Fairgrounds. Gate opens at 7 AM. Advance admission, $3; at door, $4. Register for exams as soon as possible with *Tom Krainer KEØY, 905 Leroy St., Muscatine IA 52761; 319-264-3259*. For table reservations, contact *Ken Kucera KAØY, RR2 Box 52A, Riverside IA 52327; 319-648-5037*. Talk-in on 146.25/.85, 146.31/.91.

YONKERS NY
OCT 2

The Yonkers ARC is sponsoring the Electronics Fair and Giant Flea Market at the Yonkers Municipal Parking Garage from 9 AM to 3 PM. Two floors of new and used equipment, hourly prizes, giant auction, live demonstrations. Admission, $3. Sellers, $8 per parking space. Bring tables. Talk-in on 146.865/R, 440.150/R, and 146.52. *YARC, 53 Hayward St., Yonkers NY 10704; 914-969-1053.*

HARLINGEN TX
OCT 7-8

The South Texas Amateur Repeater Society (STARS) is sponsoring the commemorative station N5CAF to celebrate the Confederate Air Force's annual Air Show in Harlingen. They will attempt to contact WWII aircraft in the CAF inventory. Listen for operation from a B-29, B-17, B-25, P-51, P-40, etc. Station operation from 8 AM to 8 PM on SSB frequencies 14260, 21360, and 28460. For certificate QSL, send QSL and SASE to *Dr. David Woolweaver K5RAV, 2210 S. 77 Sunshine Strip, Harlingen TX 78550.*

STRATFORD CT
OCT 8

The Stratford ARC will operate W1ORS from 1300Z to 1900Z to celebrate the club's 50th anniversary. Suggested frequencies, lower third of the General 40, 20, 15 meter bands and the Novice portion of 10 meters. For certificate, send QSL, contact number, and 8½"x 11" SASE (2 units of postage, please) to *KA1JKT, 307 Park Street, Stratford CT 06497.*

POTEAU OK
OCT 8-9

The Fort Smith (Arkansas) Area ARC will operate special event station W5ANR in conjunction with the 2nd Annual Green Country Sorghum Festival in Poteau, Oklahoma. Operation is from 1400-2300Z the 8th and 1400-2200Z the 9th in the lower 30 kHz of the general phone bands, 28.435 in Novice phone, and 145.01 on packet. For certificate, send QSL and SASE to *FSAARC, W5ANR, Box 32, Fort Smith AR 72902-0032.*

LANSING MI
OCT 9

The Central Michigan ARC and the Lansing Civil Defense Repeater Association are sponsoring Ham-Fair '88 from 8 AM to 3 PM in the Lansing Civic Center's Exhibition Hall. Vendors, spacious flea market, plenty of tables available ($1.50 per foot). Admission, $3.50. Talk-in frequencies are 145.39 and 146.94. Contact *Rowena Elrod KA8OBS, 111 Lancelot Place, Lansing MI 48906; 517-482-9650.*

LIMA OH
OCT 9

The Northwest Ohio ARC will hold their annual Hamfest at the Allen County Fairgrounds. Set up after 3 PM Saturday, all night security provided. Tickets, $3.50 advance; $4 at door. Tables $8, half-table $4. Exams all levels, Form 610 with copy of present license with SASE to *W8TY 1370 Stevick Rd., Lima OH 45807*. Tickets and table reservations, SASE to *WD8BND, PO Box 211, Lima OH 45802; 419-647-6513*. Talk-in on 146.67/.07, 147.03/.63, 444.925/449.925. *All areas at Hamfest handicap accessible.*

QUEENS NY
OCT 9

The Hall of Science ARC Hamfest will be at the New York Hall of Science parking lot in Flushing Meadow Park. Doors open at 9 AM. Set up is after 7:30 AM. Amateur radio exhibit station, tune-up clinic, films. Admission, $3. Sellers, $5 per space. Talk-in on 144.300 simplex link 223.600 repeat, and 445.225 repeat. Call *Steve Greenbaum WB2KDG, nights, at 718-898-5599 or Arnie Schiffman WB2YXB at 718-343-0172* or write *Stephen Greenbaum, 85-10 34th Ave., Jackson Hgts., New York NY 11372.*(Rain Date Oct 16)

SYRACUSE NY
OCT 15

The Radio Amateurs of Greater Syracuse will hold their 33rd Hamfest in the Arts and Home Center at the New York State Fairgrounds from 9 AM to 5 PM. Tech-talks, contests, entertainment, giant indoor flea market ($6 per table), commercial vendors. Tailgating area ($3 per car). Admission, $4. Pre-register for FCC exams by October 7. Send SASE if you need Form 610. Talk-in on 146.31/.91 and 147.90/.30. For more information, call *Ed Swiatlowski WA2URK, at 315-487-3417 or*

Viv Douglas WA2PUU, at 315-469-0590 or write *RAGS, PO Box 88, Liverpool NY 13088.*

ROCK HILL SC
OCT 16

The York County ARS will hold their 37th Annual Hamfest at the Joslyn Park, Museum Road. Admission, $3 in advance or $4 at gate. Talk-in on 147.03/6.43 MHz. For tickets or information, contact *Frank Bateman N4HRP, PO Box 4141 CRS, Rock Hill SC 29731.*

WEBSTER NY
OCT 22

The Xerox Amateur Radio Club will operate KE2T from 000Z to 2400Z to commemorate the 50th Anniversary of the Invention of Xerography by Chester Carlson. Phone operation will be in the lower 25 kHz of the general 80, 40, 20, 15, and 10 meter bands, and the Novice portion of the 10 meter band; CW, 50 kHz above the lower band edges. For certificate, send QSL and a business-size SASE to *XARC, Building 337, Joseph C. Wilson Center for Technology, 800 Phillips Rd., Webster NY 14580.*

KALAMAZOO MI
OCT 23

The Southwest Michigan Amateur Radio Team and the Kalamazoo ARC are sponsoring the 6th annual Kalamazoo Hamfest at Kalamazoo Central High School. Sellers set up at 6 AM. Doors open at 8 AM. Talk-in on 147.64/.04 repeater. Forums, walk-in VE testing at 9 AM. Admission $3, $2 in advance. Tables, $6. Send requests and payment before October 1 to *Gary Hazelton KB8PL, 67332 32nd St., Lawton MI 49065.* Checks payable to Kalamazoo Hamfest.

LONDON ONTARIO
OCT 23

The London Amateur Radio Club Fleamarket will take place at the Pot of Gold Bingo Palace from 9 AM to 2 PM. Admission is $3, vendors $4/table. Talk-in on VE3LAC 147.66/147.06. Contact *London Amateur Radio Club, PO Box 82, Station B, London Ont. N6A 4V3. %Dave Noon VE3IAE; 519-453-2292.*

GRANDVIEW MO
OCT 29

The Southside ARC is sponsoring its Hamfest at the Grandview Jr. High from 8 AM to 4 PM. Swap tables, $7 (includes 1 ticket); exams, seminars. $2 per ticket, four for $5 in advance, three for $5 at door. Talkin-in on 147.72/.12. Contact *Southside ARC, PO Box 1142, Grandview MO 64030 or call Walt NB0E; at 816-763-9637.*

MINNEAPOLIS MN
OCT 29

The Minnesota Hamfest & Computer Expo will be at the Hennepin Technical Institute. It will feature guest speaker Roy Neal K6DUE, former NBC Science and Space Shuttle Correspondent. Packet demonstrations, ARRL forum, new and used equipment, giant flea market, VE exams, and a CW contest. Talk-in is on 146.16/.76. Admission $4 in advance, $5 at door. Regarding VE exams, contact *Ron Schulz NA0U, 6308 Peacedale Ave., Edina MN 55424; 612-920-7473.* SASE and check for $4.55. For advance tickets and information, contact *Minnesota Hamfest & Computer Expo, PO Box 5598, Hopkins MN 55343, or call Mike Sigelman K0BUD at 612-542-8450.*

CHATTANOOGA TN
OCT 29–30

The 10th Annual Hamfest Chattanooga Amateur Radio and Computer Convention will be at the Convention and Trade Center. It features exams (apply by Oct. 26), indoor exhibitor and flea market displays (tables $10/day, $15/both days), forums. Free admission. Group rates for lodging. For additional information, write *Hamfest Chattanooga, PO Box 3377, Chattanooga TN 37404.* For Exhibitor information, call *Barbara Gregory WA4RMC at 615-892-8889*; for flea market information, call *Terry Davis KB4TZ at 615-886-6812.*

KINGSTON OK
OCT 29–30

The Texoma Hamarama Association is sponsoring the Oklahoma State Convention in conjunction with TEXOMA HAMARAMA '88 from 8 AM to 5 PM on the 29th, and from 8 AM until noon on the 30th. Equipment dealers, flea market, technical forums, ARRL activities, auction, exams, Wouff Hong Ceremony, banquet and dance, QCWA breakfast. Special rates at lodge (call 405-564-2311). For more information, contact *Texoma Hamarama Association, PO Box 610892, DFW Airport TX 75261 or call Dave Cox NB5N, at 918-250-2285.*

MARION OH
OCT 30

The Marion Amateur Radio Club will hold its 14th Annual Heart of Ohio Ham Fiesta from 0800Z to 1600Z at the Marion County Fairgrounds Coliseum. Tickets $3 in advance, $4 at door. Tables, $5. Check-in on 146.52 or 147.90/.30. For information, tickets, or tables, contact *Ed Margraff KD8OC, 1989 Weiss Ave., Marion OH 43302; 614-382-2608.*

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Number 23 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston, TX 77083

It Works!

AMSAT-OSCAR-13 is proving to be the finest amateur satellite ever. The design and construction groups around the world deserve our thanks, an extra pat on the back, and our continuing support with their ambitious projects for the future.

Work is underway in West Germany on Phase 3D, a more powerful version of OSCAR 13. Phase 3D will resemble a large doughnut over six feet in diameter and three feet thick. In addition to its hamsat duties, it will also be part of the adapter ring to mate an Ariane launcher to its main payload. Launch is expected sometime in the mid-1990s. The proposed orbit will again be highly elliptical, like that of OSCAR 13.

Geostationary Sats

Here in the States, studies have been going on for several years in preparation for the first geostationary, or Phase 4 satellite. Although current designs are very similar to the Phase 3D configuration from AMSAT-DL, the antennas, stabilization and station-keeping systems differ greatly.

Antennas on Phase 3 satellites produce gain perpendicular to the upper surface of the structure. Phase 4 antennas will be yagi and helix types with a perpendicular orientation to the solar panel faces.

While current amateur satellites are spin-stabilized, the Phase 4 series will require a different method. Commercial TV satellites use high-gain dishes aimed at North America. The dish is stationary relative to its target area and the satellite is stabilized with either a rotating body or a flywheel. Both methods are complex and expensive. Phase 4 satellites will be held steady by magnetic fluids pumped through tubing positioned around the satellite's periphery. There will be no moving parts, pumping will be achieved electromagnetically.

Small steering jets will keep the satellite positioned above a specific point on the equator. All geostationary satellites require them. They are used to place the satellite accurately and to counter drift relative to the earth's surface. The jets are designed to have sufficient propellant to allow the satellite to be moved to new locations around the geostationary belt. Additionally, they provide station-keeping for the expected life of the satellite. Phase 4 will require only sufficient fuel for initial positioning to maintain orbit for the satellite's lifetime.

Unlike the commercial TV satellites beaming only at the United States, a single Phase 4 satellite in the proper position will provide access to anyone who can "see" it. The first will likely be placed over the mid-Atlantic for hams in North and South America, western Europe, and parts of Africa. To a ground observer, the Phase 4 satellite will always appear as a stationary object in the sky with beam antennas aimed earthward.

Back To The USSR

On other fronts, new RS satellites from the Soviet Union are anticipated. Look for the launch of RS-12/13 during the summer of 1989. It will be similar to RS-10/11 with modes A (two meters up and 10 meters down), K (15 meters up and 10 meters down) and T (15 meters up and two meters down). A new more advanced RS (14?) is also in the works. Although launch is not expected until the early 1990s, its transponder package will be ambitious. Several modes are expected with B (70 cm up and two meters down), J (two meters up and 70 cm down) and others yet to be defined.

Here in the western hemisphere a new short-term program is underway to build four small satellites for launch in late 1989 by Arianespace. They will be secondary payloads with the French SPOT-2 mission. AMSAT North America reports that the orbits will be sun-synchronous, like UoSAT's 9 and 11, with a 98.7 degree inclination and an altitude of 822 kilometers.

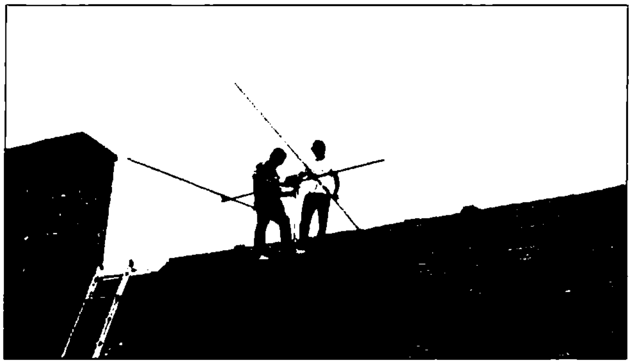

Photo A. WA5WOD and WA5TWT begin installing antennas along the fiberglass boom.

The U.S., Argentina, Brazil, and Canada are involved in design. Two of the satellites are to carry packet radio store-and-forward systems (U.S. and Argentina), one will have a downlink-only voice synthesizer (Brazil) and the fourth will carry a low-resolution CCD (charge-coupled device) TV camera from CAST, the Center for Aerospace Technology, at Weber State College in Ogden, Utah.

The satellites have been dubbed "microsats" due to their small size (9 inches on a side) and low weight (typically 22 pounds each).

Construction has begun in Boulder, Colorado. The microsat program continues AMSAT's nearly 20-year tradition of sponsoring small amateur radio payloads.

Photo B. The azimuth rotator went in the attic with a 2 x 8 between the rafters for a thrust bearing.

Get On The Stick

Many an AMSAT Area Coordinator has heard the words, "I'll wait for you guys to get a satellite up with the right orbit," or, "When you get a geostationary satellite in orbit I might get interested." Now is the time to get involved.

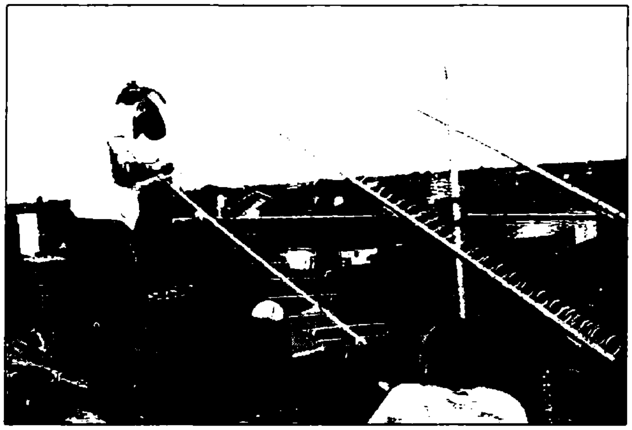

Photo C. WA5ZIB and WA5WOD fine tune element alignment on the 70 cm antenna.

There has never been a better moment for amateur satellite activity. OSCAR 13 is the embodiment of a decade-old program to place a hamsat into an orbit favoring the major population centers of the world. Although tentative launch dates are available for all of the satellites of the future, delays occur. Our space shuttle program is evidence of unforeseen pitfalls and their unfortunate effects and interruptions. Looking forward to the endless possibilities of future amateur satellites is fine, but experience with today's satellites is a prerequisite.

RS-10/11, Fuji-OSCAR 12, OSCAR 10, and OSCAR 13 have sev-

Continued on page 69

Number 24 on your Feedback card

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MARCO: Medical Amateur Radio Council operates daily and Sunday nets Medically oriented amateurs (physicians, dentists, veterinarians, nurses, therapists etc) invited to join For information, write MARCO, Box 73's, Acme, PA 15610 BNB612

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WANTED: Ham Equipment and other property. The radio club of Junior High School 22 NYC, Inc is a nonprofit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of ham radio to further and enhance the education of young people. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. Your card is invited for our "QSL of the Week Award" contest and please join the "Classroom Net" on 7.238 at 7AM daily Contact WB2JKJ using the callbook or telephone 516-674-4072, 24 hours, seven days a week Thank you! BNB762

1988 "Blossomland Blast" Sunday, October 2, 1988. Write "Blast," P.O. Box 175, St Joseph, MI 49065. BNB764

INDIVIDUAL PHOTOFACT FOLDERS. #1 to #1400, $4.00. #1401 up, $8.00. Sams books, $7.00. Postpaid. Aleen Loeb, 414 Chestnut Lane, East meaddow, NY 11554. BNB766

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SCARA INDOOR HAM RADIO AND COMPUTER FLEA MARKET Sunday, November 13, 1988 at the North Haven Park and Recreation Center, 7 Linsley St., North Haven, CT Sellers admitted at 7 AM, Buyers from 9 AM to 3PM. Tables are $12 in advance, $15 at the door. General admission $3 per person. Talk-in on 146.01/.61. Reservations for tables must be received with check by November 2, 1988, and NO reservations by phone. For information or reservations, SASE to: SCARA Fleamarket, PO Box 81, North Haven, CT 06473 or call between 7 PM and 10 PM Brad at 203-265-6478 BNB783

DIGITAL FILTER DESIGN PROGRAM for OPTIMAL FIR filters of 3 to 128 stages. PC/Clones. Lists coefficients, plus list and plot of frequency response With manual, $45. SASE for details. Paul Selwa NB9K, 61 E Tilden Dr., Brownsburg, IN 46112. BNB784

FREE HAM EQUIPMENT, details $1. PO Box 1631, Arvada, CO 80001. BNB785

Continued from page 67

eral transponders with many hours of operating time each day. Choose from the basic low-orbit mode A work on RS-11, to the highly technical RUDAK, the German packet-radio experiment using mode L frequencies (23 cm up and 70 cm down) on OSCAR 13.

In the middle ground are the VHF/UHF modes (B and J) on OSCAR 13, which are favored by most current and potential amateur satellite enthusiasts. It is important to find radios and antennas to operate on these modes.

Just a look at the advertisements in this magazine, or any other amateur radio publication, reveals many types of VHF and UHF all-mode transceivers. There are options with power output levels ranging from ten to nearly 100 watts and features from the no-frills basic mobile rig to complex bells-and-whistles base stations. For the majority, the problem is to find the most rig for the least money.

My own system consists of older HF rigs used with transverters and power amplifiers. About 100 watts is available for the VHF and UHF uplinks. Preamps include GaAsFET, MOSFET and bipolar versions, depending on the band and incoming signal levels. When atmospheric or man-made noise is high, however, a preamp is much less useful—it amplifies all incoming signals, including the noise.

> ***"Phase 4 satellites will be held steady by magnetic fluids pumped through tubing around the satellite's periphery."***

An uncomplicated setup and easy to operate components are key factors for enjoyable satellite chasing. My station includes many electronic boxes, but it's easy to use.

Keep feedlines short to provide low loss. Belden 9913 provides the best cost-effective approach.

Several individual antennas or OSCAR antenna packages are available from manufacturers. Names to look for include Cushcraft, Telex/Hy-gain, and KLM/Mirage. While the Cushcraft antennas do not include polarization switching or complete stainless-steel hardware, they are the least expensive. The KLM/Mirage antennas, especially the 22C for two meters and the 40CX for 70 cm, provide all the gain and features needed, but the price is high. Telex/Hy-gain satellite antennas are perhaps the "best buy" since they have switching and the stainless hardware, but at a more palatable price.

With my recent move, a change of antennas was in order. Deed restrictions would not allow a large array. I got one of the new antennas in a trade and bought a second for a good price at a swap-meet. The system includes a 14 element crossed yagi for two meters by KLM, a 38 element crossed yagi for 70 cm by Tonna, and a 45 element horizontally polarized loop yagi for 23 cm from Down East Microwave. The two-meter antenna has circularity switching but the 70 cm antenna is hard-wired for right hand circular to agree with most transponders in the sky. Transmission line on all bands consists of 50 foot runs of 9913. Although changes will be needed for the mode L uplink, the rest of the system is performing remarkably well on OSCARs 10 and 13.

My signals through mode L are very weak. Power output to the 9913 coax is about eight watts. Improvements will include a small linear amplifier (30 to 40 watts), better feedline (⅞ inch Heliax) and a crossed yagi tuned to 1269 MHz. The current loop yagi was built for 1296 MHz. I may realize a ten dB improvement with these changes. In the meantime, I will settle for excellent DX and some great contacts through modes B and J via the highest repeater around. ■

ATV

Ham Television

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

Vertical Vs. Horizontal Antennas

A few years ago, four of us stunned the ATV (Fast Scan) establishment with the announcement of some serious experimentation and testing work of Alford Slot UHF 70 cm antennas. The experiments and tests were conducted by Merle Reynolds W9DNT of the BRATS Iowa/Illinois ATV Club, Gerald Cromer K4HNH, and Hap Griffin WA4UMU of the Palmetto, South Carolina, ATV Club. Over the past few years, we have all taken a lot of comments like "it can't be done," "your testing is very misleading," or "there are no horizontally polarized, omnidirectional antennas with gain, but there are a lot of 10 dBd vertical ones." The last one is our favorite west coast comment that keeps our spirit for this challenge alive.

The arguments over the years about vertical versus horizontal antennas were hashed over many times. The mention of this subject usually stirs quite a controversy. W9DNT, K4NHN, and WA4UMU decided to quit talking about it and start doing something about it! Nearly three years later, after a lot of hard researching, building and testing, ATV horizontal "slots" are now popping up all over the place on ATV repeaters and remote transmitter systems (Sumter, Davenport, Minneapolis, Philadelphia, Kansas City, Central Texas, Oklahoma, Connecticut, and elsewhere). Even ATV simplex and 432 MHz SSBers have taken a shine to these unusual antennas. Measured testing on calibrated equipment and proper test ranges rate these antennas (dual-stacked models), at 7-10 dBi. These gain figures favorably compare to, and in some cases actually out-shine, those of amateur vertical ground-plane "omni" systems. The slots radiate a toast shape, near-omni pattern, with side loss rejection measuring less than 1 dB down. There's a little bit more forward gain on the front end or slot opening of the array than on the back. These home-brew antennas run anywhere from $20 to $40, depending upon the length and materials used. The solid-wall "infinite halo" slots designed by W9DNT are the most ruggedly built of the slots, and so can survive tower icing conditions far better than any amateur ground plane product. K4NHN's rib-caged slots are taller, lighter, and have more gain on single array versions.

Over the past few years, *The Spec-Com (USATVS) Journal* featured quite a few articles on the slot design for ATV operation. The special fifty-page Alford Slot theory and design information is available (thanks to K4NHN) in the *ESF Copy Service's #109 UHF Antenna Reprint Booklet* for $10 (4015 Clearview Drive, Cedar Falls, Iowa 50613). An extensive technical article by Hap Griffin WA4UMU describing testing procedures for Slots appeared in the June 1988 issue of *Spec-Com*. The antenna designs by W9DNT appeared in the May 1988 *Spec-Com* issue.

3.5" 70 cm Single or Dual Slot

The new 200Ω impedance 3.5" diameter Alford Slot antenna for ATV/SSB is made out of galvanized tin gutter or stovepipe metal. The single array is only 5' tall, with a circumference a little over 11." A ½" slot opening is recommended. A 4-to-1 coaxial balun taken from the *ARRL Antenna Handbook* brings the 200Ω impedance down to 50Ω. Use the formula: "492 divided by (f), times 12", times coax velocity formula" to determine the connection harness (439.25 MHz will end up being about 10"—421.250 MHz at 11"). RG-8X is used on this model, with Belden 8214 for the longer section. Dual-stacking a pair of these antennas gives more gain, and you can use a common T-splitter to join the two antennas. Coaxial feedpoint is located in the center of the antenna. Brass shorting bars are used to electrically terminate antenna radiation. Support is added as PVC ring collars. The entire array may be incased in PVC or plastic/rubber corrugated tubing. Seal the slot opening to prevent howling or whistling. Coat the entire antenna with Tenna Cote™ or similar protective finish coating.

Smaller, Lighter 902-928 MHz Design!

At the request of several FSTV individuals who voiced their requests at the 1988 Dayton ATV Workshop sessions, W9DNT built, in just a few hours, a completely new smaller and lightweight "dual" 900 MHz Slot antenna array. This new antenna covers the entire 902-928 MHz frequency range. With the use of a large umbrella, these two joined (200Ω), "single" Slots give good gain at about half the price. Those of you beginning to play with 900 MHz, or building a 900 MHz ATV repeater input or output, should take a good look at what Merle has achieved! The same U-shaped coaxial balun is used as on the 3.5" 70 cm Slot, only now the length is around 5". There is a 2¼" gap between the two antennas. The slot opening is ⅛"

These antennas should be mounted as the "top most" antenna on the structure or tower. Don't use a side-arm bracket mount, as that will cause the radiation pattern to distort toward the tower. Keep the antenna at least 2 or more feet away from the supporting structure. Contact Merle Reynolds by writing to him at 710 25th Avenue Court, Moline, Illinois, 61265 or by calling him (no collect calls accepted), between noon and 9 PM at (309) 764-1685.

As the popularity of the ATV mode continues to grow, more ATV repeaters and remote transmitters (weather radar), will be coming on the air. It's important to first recognize the established antenna plane of operation in your own area. If it is vertical, then by all means stay upright. If it is predominantly horizontal, then, thanks to W9DNT, K4NHN, WA4UMU and others, there are no longer any excuses for not building a horizontally polarized ATV repeater system!

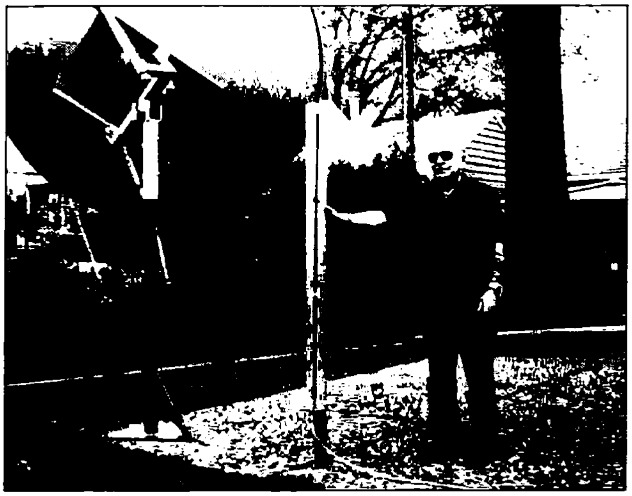


Photo A. Merle Reynolds W9DNT holding an Alford Slot antenna.

QRM Relief?

While some ATV groups continue to fight and hold out at all costs against the previously mentioned horizontal antenna polarization standardization move, others are learning of a rewarding, no-cost, 20 plus dB FM QRM isolation method! Take my favorite problem target group in the Indianapolis area. They have a vertical on their repeater system on a tall State Police Tower, just south of town and have, because of terrible FM repeater QRM problems, retweaked their repeater's sideband product to accept the LSB audio sub-carrier instead of the upper. The Omaha, Nebraska area has done the same and, in fact, got this procedure entered in the regional FC policies. Both cities could benefit even further by building a W9DNT Slot—this would give them an additional 20 dB of isolation and get them on the same DX plane with the rest of the world! (TV video duplexers are now available from TX/RX and other manufacturers of single-antenna array systems.) The fellas on the Indy ATV repeater seem content year after year working a limited number of people over a limited number of miles.

We are now receiving the logsheet results of last month's USATVS sponsored 7th Annual "North American Fast TV UHF QSO and DX Contest!" Stay tuned for the results! We had a great activity turnout and some "long hauls!"

Number 27 on your Feedback card

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
P.O. Box 1079
Payson, AZ 85541

Propagation Forecast

HF propagation conditions during the month of October should be better than average due to seasonal upswings in solar activity without the excessively high absorption levels of the summer months. The sunspot numbers continue with the rising of Cycle 22, and the still almost-equal numbers of daylight and darkness hours contribute to excellent HF propagation. You may find that geomagnetic field disturbances will ruin some otherwise good days, so a constant check of WWV at 18 minutes after the hour will keep you apprised of changes in solar flux values and geomagnetic field conditions. Once again, look for solar flux values of 150 or higher. The higher the solar flux and the lower the A index, the better propagation will be.

You will want to look at two specific areas of the accompanying charts: the *daily* letters G=Good, F=Fair, and P=Poor; and the trends, such as F–P, for example, which means Fair conditions trending to Poor. The second area to be aware of is the MUF, or maximum usable frequency. Our charts show which bands are expected to be usable from one part of the world to another, and what time to expect these openings. On a day where "P" conditions prevail, it is unlikely that you will be able to contact Timbuktu at a band and time when there are no expected openings to Africa. On the other hand, when a "G" symbol is given for a particular day, and when openings are anticipated at a certain time to a particular area of the world, it would be very beneficial to keep the receiver sharp-tuned for DX signals from the indicated areas.

If you have a beam antenna of some kind, it may help to pick up the weaker signals from early band openings. Even on "Good" days, you can't always expect to hear exotic calls roaring through the loudspeaker or earphones. Patience, and an ability to dig out the weak signals, will prove to be assets. That DX station may be one that has a poor antenna and a very low-power transmitter!

Be aware of excellent possibilities just before dark and just after dawn—the so-called "gray-line DX" opportunity. Signals seem to propagate particularly well along the earth's line of darkness as it approaches any given area. Perhaps not so obvious is the fact that as darkness advances in one area of the world, it retreats in another, and these two areas may be accessible to one another by propagation of HF signals. Quite often, signals propagated along the "gray-line" have unusual strengths at the receiving end. Also, these signals may arrive from unexpected directions, compared to signals received during either the daylight or darkness hours.

We have discussed DX and "long-skip," multi-hop propagation in these pages almost to the exclusion of the "other" type of propagation called "short skip." It might be worthwhile to talk just a little about short skip opportunities; that is, the propagation of signals over distances of approximately 100 to 2500 miles.

This type of propagation occurs mostly in single-hop, rather than multi-hop, stages and may be predominantly F_2-layer propagation, at least on frequencies above 14 MHz. Short skip usually begins with shorter distances in the morning hours increasing to longer distances in the darkness hours before midnight local time. Short skip propagation can be useful if you know where and when to look, and also for the purpose of "keeping a sked" with a friend in another part of the country. Looking at it in another light, you can think of DX as "long skip" and everything else as short- or medium-skip propagation. It is probably best to discuss short skip in terms of a band-by-band summary, beginning with 160 meters and ending with 10 meters. During the days when conditions are generally listed as "Good" or "Fair" in our calendar, skip distances will change with time and frequency. On "Fair" or "Poor" days, you may not be able to work any short skip at all.

To use short skip, consider the midpoint of the path between any two locations. The local time at the midpoint determines the time at your end of the path and at the other end of the path, when the short skip path crosses several time zones. ■

See next month's column for examples on how to use the charts to determine short skip.

OCTOBER 1988

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G
2 G	3 G	4 G	5 G–F	6 F–P	7 P	8 P
9 P	10 P	11 P	12 P–F	13 F	14 F	15 F–G
16 G	17 G	18 G	19 G	20 G–F	21 F	22 F
23 F–P / 30 G	24 P / 31 G	25 P	26 P–F	27 F–G	28 G	29 G

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	20	20	-	-	-	15
ARGENTINA	20	20	40	40	-	-	-	-	-	10	10	15
AUSTRALIA	15	-	20	-	-	40	20	20				15
PANAMA	15	20	40*	40*	40	-	20	20	20	10	10	15
WESTERN EUROPE	40	40	40*	40	-	-	20	15	10	10	20	20
HAWAII	15	20	20	40	40	40	20	20	-	-	10	20/15
INDIA	-	-	-	-	-	-	20	20	-	-	-	-
JAPAN	15	20	-	-	-	-	20	20	-	-	-	15
MEXICO	15	20	40*	40*	40	-	20	20	20	10	10	15
PHILIPPINES	-	-	-	-	-	-	20	20	-	-	-	-
PUERTO RICO	15	20	40*	40*	40	-	20	20	20	10	10	15
SOUTH AFRICA	20	-	-	-	-	-	-	-	15	15	10	20
U.S.S.R	20	40	-	-	-	-	-	15	15	20	-	-
WEST COAST	40	80	-	-	-	-	-	20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	-	-	-	-	-	-	-	-	-	-	15
ARGENTINA	15	20	20	40	40	-	-	-	-	-	10	15
AUSTRALIA	15	20	20	20	-	40	80	-	-	-	-	15
PANAMA	15	20	20	40*	40*	-	-	15	15	10	10	15
WESTERN EUROPE	-	40/80	40/80	-	-	15/20	15	15	20	20	20	-
HAWAII	15	20	20	40	40	40*	80	20	-	-	10	15
INDIA	-	-	-	-	-	-	-	20	-	-	-	-
JAPAN	15	-	-	-	-	-	-	-	-	-	-	15
MEXICO	15	20	20	40*	40*	-	-	15	15	10	10	15
PHILIPPINES	15	20	-	-	-	-	-	20	-	-	-	-
PUERTO RICO	15	20	20	40*	40*	-	-	15	15	10	10	15
SOUTH AFRICA	20	-	-	-	-	-	-	-	-	15	15	20
U.S.S.R.	-	-	-	-	-	-	-	20	15	20	-	-

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	15	20	20	20	40	40	-	-	-	15
ARGENTINA	10/15	20	20	40-	-	-	-	-	-	-	15	10/15
AUSTRALIA	10	15	15	20	20	40-	40	40-	20	20	15/20	15
PANAMA	20	20	40/20	40/20	40	-	-	20	15	15	10	10
WESTERN EUROPE	-	-	-	-	-	-	-	-	-	15/20	15/20	-
HAWAII	10	15	20/15	40	40*	40*	40	40	-	20	20	20
INDIA	15/20	15/20	-	-	-	-	-	-	20-	-	-	-
JAPAN	10/15	15	15	20	20	20	40-	40-	-	-	-	15
MEXICO	20	20	40/20	40/20	40	-	-	20	15	15	10	10
PHILIPPINES	15/20	15/20	-	20-	-	40-	40-	-	20	20	-	15
PUERTO RICO	20	20	40/20	40/20	40	-	-	20	15	15	10	10
SOUTH AFRICA	20	20	-	-	-	-	-	-	-	15	15	20/15
U.S.S.R.	-	-	-	-	-	-	-	-	20	-	-	-
EAST COAST	40	80	-	-	-	-	-	20	20	20	15	40

Inexpensive Display for Weather Satellite Pictures

Set up your microcomputer to receive WEFAX pictures.

by Vince Coppola N1VC

After a few years of receiving quality pictures on old surplus weather recorders, I got tired of their many problems, including balkiness, foul odors, and expensive paper. My thoughts led to digitizing the picture with a microcomputer.

This project, which I took on about 5 years ago, was developed on an S-100 bus system. My board would display an image of 256 pixels horizontal, by 128 pixels vertical, by 16 gray levels. It did not take long to fill up a board with RAM chips and other components to achieve this size image, nor did it take long to exceed my budget. With the technology of even just a few years ago, I was unable to duplicate the nice quality pictures I was getting from my old boat anchor recorders.

Recently, I saw the specs on the Imagewise board developed by Circuit Cellar 1, with 256 horizontal, by 244 vertical, by 6 bits. This could double the vertical area of my picture and increase my gray scale to 64 levels. This should improve my picture quality, getting rid of jaggedness on certain details caused by digitization. Another nice feature is that it is driven by a serial port. I could connect the display board to any computer I wished, as long as it had an RS-232 port.

One candidate was my CoCo II which already had a built-in A/D converter. I choose my IBM AT clone, however, because it has much more memory, and the Imagewise drivers and image processing routines were already available from Circuit Cellar. The only thing I needed was a 6-bit A/D board with a parallel port that would allow me to sample at about 100 microseconds. I came up with the design in Figure 1. I settled for an 8 bit A/D just in case I needed it for a future project that would yield 256 gray levels. The 100 microseconds is probably overkill, but this will work out very nicely for my next project with the Imagewise board slow scan television.

The article doesn't deal with the details of building the entire station—check out References 2 and 3 for that. (Reference 3 also contains some very useful information for satellite identification.) What I show here is how to send the demodulated video signal and the sync pulses to an A/D interface board in the IBM PC, sample and store them, and send the data out an RS-232 port to Imagewise. Of course, since the image is stored in a disk file, image processing can remove noise, and it's possible also to run an image enhancement program on it, to bring out ground, cloud details, etc. A higher level language, such as "C" or BASIC, handles the gory math.

Refer to Figure 2. The 137 MHz AM signal is received from the satellite, fed into the video demodulator, in this case, also into the RTM CCF-2 board 4. The video output sig-

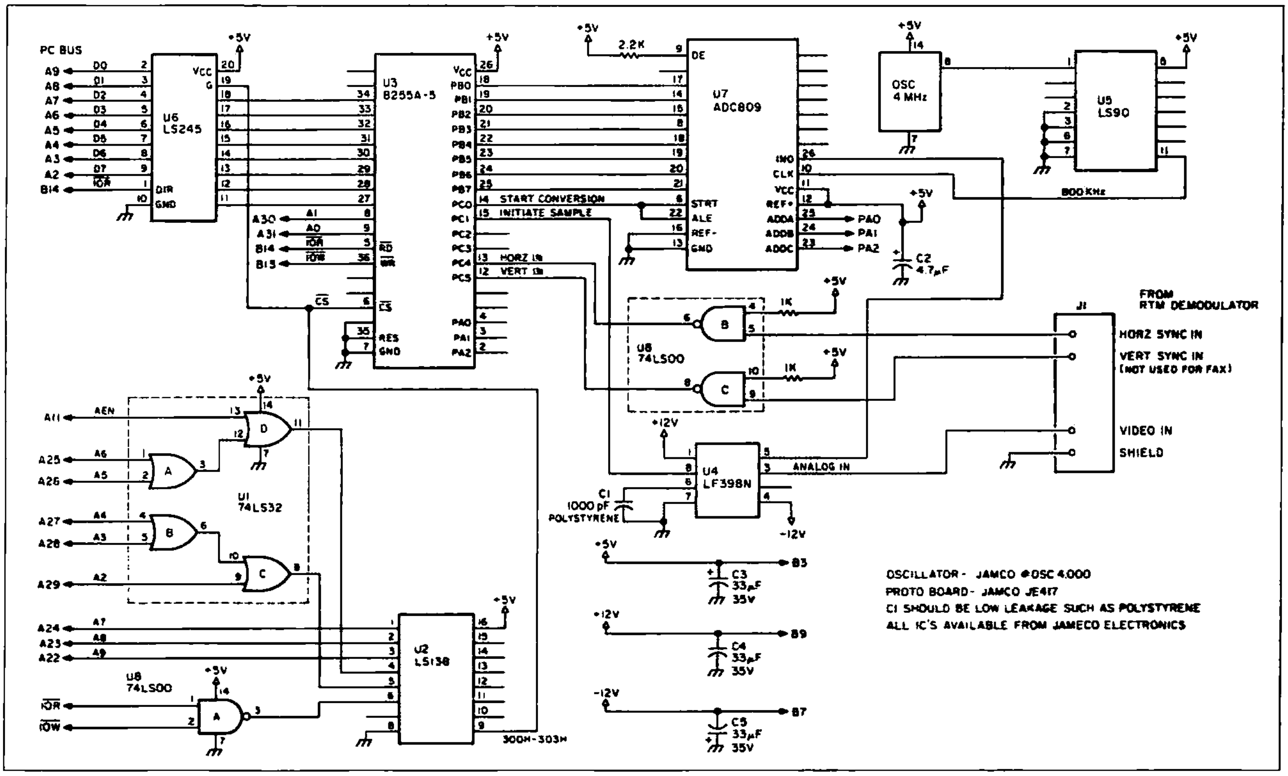


Figure 1. Schematic for the 6-bit A/D converter with a parallel port.

nal is then converted to a 0-to-5 volt signal. Zero volts represents black, 5 volts represents white, and everything in between is a gray level. This is fed into the A/D converter where it is sampled and stored to RAM at fixed intervals by the PC. This is simple so far, but sync information is still needed.

Horizontal Sync Pulse

With a 120 line-per-minute (LPM) transmission rate, the unit receives a line every 0.5 seconds. If we generate an accurate 0.5 second-spaced pulse of about 5 millisecond duration (a standard duration), we can use this as the horizontal sync pulse for telling us when to start displaying a new line. On the RTM board, this .5 sec pulse is derived from the on-board crystal oscillator and also has a circuit built in for manual phasing of the image. What this means is, if the picture is out of phase with the locally generated sync pulse, then we can press this switch down until the view is the way we want it.

Another nice feature of the RTM board is that it allows video storage on a stereo tape recorder.

Now that the horizontal sync pulse has been generated, it is fed into the 8255 port on the A/D board. This tells the program when to store a sync pulse byte (41H) into the stored image file, so the Imagewise receiver board will know when to start a new line . At the beginning of the image in memory, we store a start of Frame byte (40H). This tells Imagewise that a new picture is coming. When we have filled up the 62K with imagery, we place an End of Frame byte at the end (42H). The software automatically saves the 62k image to disk when the image has finished scanning, and invokes SHOW.COM to display the image to Imagewise.

An important point is that the Imagewise file format is not much different from the PIX file format used on the ROBOT 1200. The only differences are the Start of Frame byte, the End of Frame byte, and the new line bytes that are added to Imagewise. John Williams of the Datalink BBS wrote programs that will convert files both ways. It's available for downloading from that source.

Circuit Description

The circuit was designed for the IBM PC bus. The 8255 parallel I/O is the heart of the board, and is capable of reading or writing to three 8-bit ports: 300, 301, and 302. The board is set up to be used in the prototype area of the PC and uses ports 300H-303H. Port 303H is where the configuration byte or control byte is stored for the 8255. Ports A, B, and C correspond to locations 300H-302H, respectively. Port A is configured as an output port, port B as an input port, and Port C is split up into both input and output ports. The Port C output lines control the sampling, and the A/D conversion of the video input line. When the conversion is done, the 8-bit byte is read into Port B on the 8255. The input lines of port C read the sync input lines (only horizontal sync in the case of FAX). Port A is used to select which input line of the A/D converter we are going to sample (line 0 in our case).

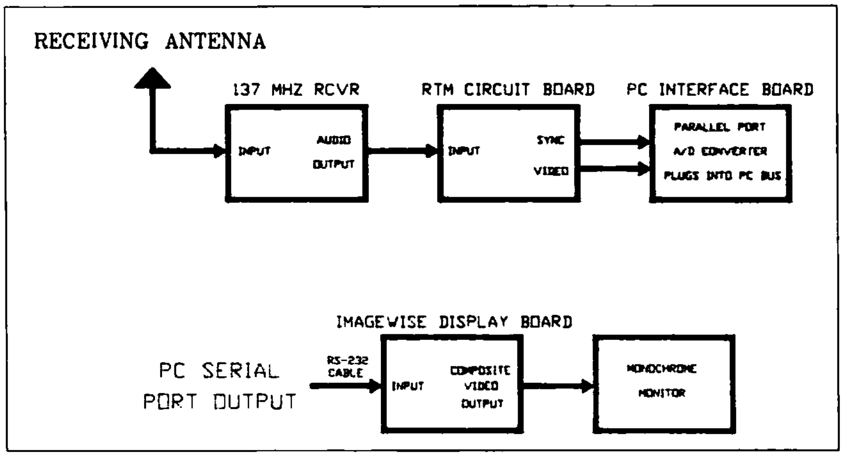


Figure 2. Flowchart for the WEFAX image reception, digitization, and display.

The clock for is supplied by an on-board oscillator. I could have stolen it from the PC bus, but doing it this way, the software becomes compatible with computers of varying clock rates, such as turbos and ATs.

Construction

The prototype was built on a short slot type wire-wrap proto board available from Jameco. The board comes without a mounting bracket. I felt that it was desirable to have one, so I mounted some homemade brackets on it, and punched a hole for the connector to the RTM board. I used a D-type connector for simplicity. Simplicity and easily obtainable parts were two objectives of this design. Placement of the parts is really not critical, but bypass capacitors of the .1 µf disc ceramic type should be placed from the 5 volt bus to ground, as close as possible to each IC on the board. I would also advise ohming out the entire circuit before plugging it in. The half hour or so you may spend in doing so may save you hours of troubleshooting. I also suggest placing the board into the PC and measuring certain points for the correct voltages before installing the ICs. This will also likely save you much trouble.

Checkout

Before trying to receive FAX, check out the video input port. Place a known DC voltage in the range of 0-5 volts on the video line. Next, insert the program disk into Disk A, and type MENU0. When the menu comes up, type a "V" to observe the voltages that print out continuously on the screen. They should indicate the correct value continuously, with maybe a slight (and negligible) error in the hundredths digit. If all is OK, then hit CNTL-Brk to exit.

You are now ready to hook up the RTM board. It is a good idea to shield these input cables and ground the shield to the PC chassis. Again insert the program disk into Drive A, and a formatted blank disk into Drive B. Type MENU0, and select the type of satellite you want to display. You should select one of the phasing keys at first. Then start the tape. If all is good, then you will see each line being scanned from the top to the bottom of your monitor, and in four colors if you have a color monitor. If no lines appear, then you are not receiving horizontal sync pulses, and you should check your wiring. If the picture has to be phased, you can do so now by holding down the phasing switch on the RTM interface. When all looks good, hit return and you will return to the menu. Now hit the correct key to receive and store the image. When the image is stored, the program will automatically store it to a file on Drive B called IMAGE.PIC. It will then attempt to send it to Imagewise using the SHOW.COM utility supplied by Circuit Cellar. The program will then return to the menu.

Additional Notes

In this article, I attempted to explain a relatively low-cost board that can display excellent results when connected to the above system. Two closing points: the files obtained with my software can be converted to PIX files format as used in the ROBOT 1200. Also available on the Datalink BBS is a program I have downloaded that will display .PIX files in EGA format. These two programs are:

EGA-PIX-Monochrome
EGA-PIX2-Color

The programs work only with 19 gray levels, but the results were pleasing, anyway, when I ran them on some polar orbiting images as well as some WEFAX frames.

References

1. Circuit Cellar—Imagewise display/receiver board partial kit, full kit, or fully assembled and tested. CCI, PO Box 428, Tolland CT 06084. (203) 875-2751.

2. *New Satellite Handbook*—by Ralph Taggart, 602 S. Jefferson, Mason MI 48854.

3 *73 Magazine* December 1984—Color SSTV PART II, by Taggart and Abrams.

4 RTM Circuit Boards, 205 Elm St., Van Horne IA 52346-0400. CCF-2 FAX Interface board.

5 Datalink RBBS—Jeff Wallach N5ITU, chairman. (214) 394-7325.

•Vince Coppola N1VC makes available the software described above on 5.25" disk to run on an IBM PC or compatible. (Note color-graphics board and color monitor are used for phasing.) $22.

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon, OH 44646

I start here with a second look at the vertical antenna. In the past, I've mentioned the ho-hum performance of the vertical antennas I have used. Larry Jones WB5KYK sent me a great letter on the vertical antenna. Apparently, he didn't like my statement that vertical antennas radiated poorly in all directions. Larry has over 29 years of experience in vertical antennas. Follow Larry's field operator's guide to verticals for a good antenna that radiates a good signal in all directions. Larry writes the following:

"So, you want to put up an antenna that doesn't require a tower. Enter the vertical, the stepchild of the antenna family. Or is it? Let's find out what really works at one's QTH and not what works just in theory.

"First understand that the very nature of this beast makes it noisy on receive, so if there is a noise problem, be ready to use a different antenna for reception. This is not much of a problem with verticals on bands above 40 meters. Do not even think about putting up a vertical if it is easier to put up than a beam. Understand that the antennas that we are talking about are those that will work. It is easy to drive a piece of pipe in the ground, bolt on a commercially made vertical, and call CQ. That is the kind of vertical that Mike was talking about. What he didn't say was that the only QTH where these antennas work worth a damn are ships at sea and islands. If that is the kind of antenna project in mind, quit reading right here, sell the QTH, and get a copy of *73* sent to the new QTH.

"Avoid any vertical that has traps in it, especially on QRP. These things make the vertical radiate poorly on more than one band, while they eat up one watt. Nothing like having a poor signal on more than one band from the same antenna! Also, avoid using loading coils at the base of the antenna. If a coil has to be used, make it with big copper (#6) wire. Solder the feedline to the tap point. Don't use some device that is easy to bolt on to the coil, supplied by a friend down the block. Chances are he got it from the vertical he took down that didn't work.

"Where does the vertical go? In the clear. It is that simple. If this can't be done by ground-mounting the vertical, try going up. Once I used a short vertical mounted to the side of a chimney on 160 meters, and it worked great. With this method, be sure that a big copper wire is run to the base of the vertical for grounding. Attach it to a good ground rod. I consider a ground rod of no less that 12 feet to be about the minimum length for above-ground installations. Be sure to run as many radials down to the ground as possible. They don't need to be the same length. I consider 16 to be a minimum number.

"These are not tuned radials, so the formula to determine their length is this: make them reach the ground as far away from the antenna as possible. The wire to make the radials really doesn't matter. Here comes the bad part. In all likelihood, a tuner will have to be used. I suggest any QRP operator get (or build) a good low power tuner. And what about the power loss in a tuner? How many hams are using RG8/U or smaller coax in a QRP operation? Why not use a hardline or 9913? I can't see how anyone could be too concerned about the loss in a properly designed tuner if they aren't concerned with that hamfest special coax. Granted, a little power will be lost in the tuner, but try connecting a power meter to the feedline at the antenna. Don't place it immediately after the tuner, but at the feedpoint. See how much power is actually getting to the antenna without a tuner. It is an illuminating observation.

"If the antenna system is to be permanent, it is always good to have insulated radial wire. Be sure to connect these above-ground radials to the antenna grounding point in an electrically sound manner. This usually means soldering. What is mechanically sound is not always electrically sound.

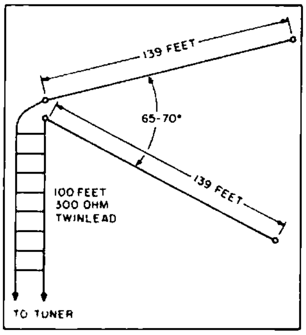


Figure 1. The 20 meter VEE beam.

"If something needs to be bolted to the antenna base for attaching radials, tin the soldering lugs with solder. The vertical antenna builder and user must fight any loss of continuity in his radial system. A cheap way to attach the radials at the end to ground, in above the ground installations, is to use aluminum tent pegs. They are durable as well as cheap. It doesn't matter if the vertical is ground-mounted or above-ground mounted. Tie the radial system into everything that will give a ground, such as chain link fences, arbor wire benches, water pipes, and steel or copper lines.

"The rule for ground- and above-ground mounted verticals is to evenly space the radials as much as possible in a 360 degree circle. Also, ground-mounted verticals should have as many radials as possible. They should be as long as they can be, up to two or three feet longer than 1/4 the wavelength on the lowest frequency used. Tie the radials into everything. I highly recommend using a large number of short radials right around the base of the antenna. How short is short? 1/16 of a wavelength will work, but 1/8 is better. If possible, put poultry wire on top of the ground around the base of the antenna. The radials will work fine on top of the ground. If they are buried, don't bury them too deep, especially if operating on 10, 15, and 20 meters.

"The best and simplest vertical is 1/4 wavelength long and operates on a single band. A 1/4 wavelength vertical cut for 7.1 MHz would only be 32.96 feet tall. A telescoping TV mast pole would work fine for this. Get a cool drink in a glass bottle to celebrate purchasing the TV mast pole and have the base insulator for the vertical. I said that a 1/4 wave vertical is the best. Let me state it this way. It is the best when considering cost, ease of installation, and feedline matching. It will work great, but there are other verticals that will out perform it.

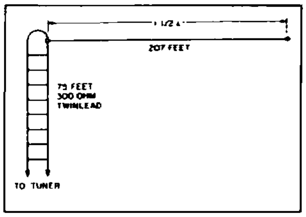


Figure 2. The 40 meter long wire antenna.

"The vertical, when operating against the proper radial system, is a low-angle radiator. The trade off for good performance at great distances is poorer performance at shorter distances. These antennas do work, and they work well for what they were designed to do—transmit well at great distances.

"At our QTH we have an inverted L (one of the many forms of the vertical) that is 1/8 wavelength long on 1.84 MHz. I have 120 ground radials down, 125 feet long, grounded to what I call my central ground hub: five ground rods, 12 feet long, arranged in a square. I have 150 ground radials that are 18 feet long and poultry wire at the base of the antenna. I'm also tied into various ground sources around the QTH. My vertical radiates equally good in all directions.

"I always enjoy hearing from people who use verticals, and

0073 Spy Key

by Skip Westrich WB8OWM

Here is a very inexpensive homebrew "0073 Spy Key," Mr. Bond. Use two dominoes, a Radio Shack 275-016 micro-switch, a dash (pardon the pun) of epoxy, and you are in business, so to speak. The key works great upright or on its side and tucks away nicely for covert operations.

One last item, Mr. Bond. The key never needs adjustment. With those 5-amp, 250 VAC contacts, this key should "Never Say Die."

So there you have it. Good luck with your mission, Mr. Bond.

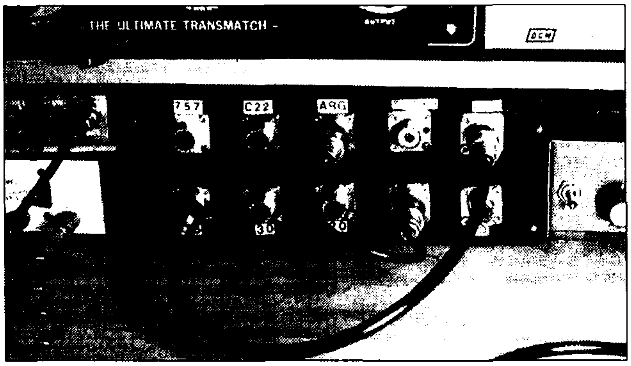


Photo A. Alan Pike's quick change antenna setup. Top row for radios, bottom row for antennas.

Photo B. Not much to it. Just some female connectors and a piece of plywood.

people who are planning vertical antenna projects. Feel free to drop me a line, SASE please." (Send your comments to Larry and not to WB8VGE.)

Write to Larry Jones WB5KYK, at Rt 12, Box 139C, Laurel MS 39440. Don't forget the SASE!

I've mentioned in the past about all those SWR meters, antenna switches, etc. we manage to put in line. Alan Pike W8MGF has a solution for a multitude of antennas and rigs. After spending a lot of time bent over the rigs, fiddling with coax connectors from this rig to that one, and trying to figure out which coax went where, Alan decided to re-engineer his antenna system.

Alan has an antenna patch panel consisting of two rows of female connectors with quick disconnect patch cables. The panel was made from an old piece of plywood. The labels came from the sheet of pressure sensitive numbers and letters that come with video tapes. The top row goes to rig/tuners. The bottom row is the termination point for his dipoles. Alan says, "It really speeds up changing antennas, and is a lot cheaper than coax switches."

Talk Field Day, and hear all about antennas. Everyone want the ultimate death ray? Here are two antennas that have worked out quite well for the Zuni-Loopers Field Day group. Fred Turpin, Bob Spidell, and Cameron Hartford.

The first antenna, the 20 meter Vee beam, is quite simple. It is two wavelengths of a leg, 139 feet, with an apex angle of 65 to 70 degrees. This antenna was hauled into the pines to a height of 50 feet. The antenna has a gain of about 5.5 dB. The Vee was found to have very low noise characteristics.

The 40 meter long wire antenna is made of 207 feet of wire feed with about 75 feet of 300Ω twinlead through a tuner in end-Zepp fashion. Tuning was broad on 40 meters but sharp on 80 meters.

Next month, I'll continue with the solar power series. After we finish applying solar power to our stations, we'll start building some receivers.

If you write a request and don't send an SASE, you may not get a reply. I can be reached via Compuserve ID# 73357,222. Also, via packet from the KA8Z BBS. Just tell whatever BBS to forward messages to me via KA8Z. 73

LETTERS

Number 33 on your Feedback card

From the Hamshack

Fox Hunting Revival

In Wayne's April editorial, he states that he hopes to get fox hunting revived in the US. I think this is a great idea, though fox hunting is not dead and has already had its own revival.

I can go on a mobile transmitter hunt at least 10 times a month in the Los Angeles area. In San Diego or Santa Barbara, there are additional hunts. These hunts are on 10, 6, 2, and 220. Participation in these hunts has grown 50 to 100 percent in the last five years. We have every kind of hunt you can imagine. Some are simple hunts where the hidden T goes out, hides, and (almost) everyone finds him in the next one to three hours. Others are more specialized.

The predominant style of fox hunting in Europe and Asia has never been popular in the US. With rare exceptions, US fox hunting is mobile, while most fox hunting in Europe is on foot, as a physical sport. The requirement for fox hunting is cross country running.

In a European or Asian fox hunt, it isn't unusual for up to five transmitters to be on the air at the same time, over hundreds of meters of hillside. Winning times of less than an hour are the norm, with the hunter being required to find all five transmitters, sometimes in a specific order.

European style fox hunting would be an ideal activity at Scouting events. This may be a way to get students into ham radio. Inexpensive DF receivers (that could also monitor the local repeaters), can be cheaply built. Building the receiver would give the Scouts experience in electronics while the actual fox hunting would combine radio, the outdoors, and learning skills with a map and compass.

How about a National Scouting Fox Hunting Championship? This would be an ideal way to get non-hams involved, since a license really isn't necessary.

T-hunting, as it is known in our country, has much to offer ham radio. T-hunting is a microcosm of ham radio, combining the camaraderie of a meeting or Field Day, the fun of a contest, public service, and the satisfaction of home-brewing. Anyone can hunt. We have blind hams that do so regularly, using an audio S-meter when turning the beam. T-hunting is a natural for high school students since it combines cars, competition among friends, and electronics.

Thomas N. Curlee WB6UZZ
Fullerton CA

In Appreciation

My husband and I are new to ham radio. I just upgraded to Tech in February, and the group of fellas where I took the test were very supportive and really pulling for me. They made me feel great. I'm very lucky to have met such a great bunch of guys, because had I run into some "Die Hards," I probably never would have gotten into amateur radio.

Earl Dugan, Director of the Greater Bridgeport Amateur Radio Club, really put me at ease and encouraged both of us, and still does. He always tells me that you can never ask a stupid question where radio is concerned. It's better to ask once or twenty times, rather than risk irreparable damage.

Beth, our daughter, who has some learning disability, is getting the bug through the Handi Ham Courage Center. They're another great group.

Millie Blotney KA1QOW
Keene NH

HI to Incarcerated Hams

I am trying to form a new amateur radio organization called "Hams Incarcerated" or "HI." The goals are: 1. to promote communications among incarcerated hams; 2. improve public awareness of the free public services rendered by ham radio; and 3. to establish an amateur radio station inside prison, primarily to provide public services, such as traffic handlers, net control, and emergency communications assistance.

If you are, or know, an incarcerated ham and you would like to QSO/QSL an incarcerated ham, please contact:

Jim Cranford 107159
P.C. Unit N5AAN
Rt. 2, Box 75
Homer LA 71040

Number 31 on your Feedback card

73 INTERNATIONAL

edited by CCC

Notes from FN42

And who, you ask, is CCC, referred to above as the editor of this column? CCC is the new Supereditor, named to honor all of this column's correspondents who from now on will be known by us as **Hambassadors** *for their countries. CCC is Chauncey Charles Cuthbraith; the name is a composite of several names of historic diplomats (real and imagined) since only such a Super-Hambassador (in real life the entire editorial staff) will be able to do justice to* **73 International** *from now on. A list of our Hambassadors will be published here early next year—if we haven't heard from you recently be sure to let us know right away that you are still a foreign correspondent for us; if you live in a country for which we have not recently had any reports, let us know if you would like to be the Hambassador for your country.*

This month CCC brings you the first revision of The 73 International Universal Permit Application. *The changes from the first draft (published in January) were based on information you sent in; the next revision will appear as soon as you send us enough (1) additional useful suggestions for further changes, and most important now, (2) any* ***special information*** *that your country requires in addition. This will be coded beginning with number 51 (see the form). Please refer to numbers 1–20, as appropriate, when making new suggestions; new additions to the basic form (if any) will be coded 21 through 49. When a final form has been developed, the numbers can be dropped, and the "Special Information" listed separately, alphabetically by country.*

October's dates to spice up your QSOs: 1—National Day in China, Cyprus, and Nigeria; 2—Thanksgiving, Germany (10th for Canada); 3—National Foundation Day, South Korea; 4—Independence Day, Lesotho (12th for Equatorial Guinea, 28th for Czechoslovakia); 5—Republic Day, Portugal (9th for Kmer Republic, Cambodia; 29th for Turkey); 7—Foundation Day, E. Germany; 8—Constitution Day, USSR; 10—Columbus Day, USA (12th for Latin America); Health-Sports Day, Japan; Kruger Day, South Africa; 12—Universal Childrens Day; National Holiday, Spain (22nd for the Vatican, 26th for Austria, 28th for Greece); 14—Young Peoples Day, Zaire; 15—Evacuation Day, Tunisia; 17—Mothers Day, Malawi; 20—1944 Revolution Anniversary, Guatemala; 21—Revolution Day, Somalia; 22—Labor Day, New Zealand; 23—Chulalongkron's Day, Thailand; ***the 24th is United Nations Day****; 27—3Z's Day, Zaire; 31—Bank Holiday, Ireland.*

Roundup

Norfolk Island (Australia). A report from Kirsti VK9NL will appear next month (we hope!) and will be under the Island's own flag (standard). Norfolk is the Pine Tree Island—the *Aurokaria*, which is grown in pots all around the world. A quick note here, however, to those awaiting QSLs: remember that one IRC means *surface* mail, i.e., boat. And boats depart Norfolk Island only every other month. Be patient. (Also don't send SASEs with Australian stamps—can't be used from Norfolk Island!) More on this in her report.

Japan. The Japan Amateur Radio League, Inc. (JARL) has begun a monthly newsletter, *The JARL News*, in English, "to provide amateur operators, radio clubs, and radio regulatory organizations, throughout the world, with news [of] Japan that might be of interest," according to Shozo Hara JA1AN, JARL president. The first issue was for June, 1988. Up-to-the-minute news of the amateur satellite, F-O-12, also will be provided. No subscription information was given, so write JARL, 14-2, Sugamo 1-chome, Tishimaku, Tokyo 170, Japan. One June news item given: Station BY7HY began operating from Yueyang City in Hunan Province, **China**, in May. JARL contributed some equipment and Noboru Takada JG2GNX led a five-member delegation to the opening ceremony.

In the July issue a list of special event stations was given, only one of which will still be operating this month (the issue was received July 25th, a week before the deadline for this October column). October 23 will be the last day for 8J3SLK, operating from Nara City at the site of the Nara Silkroad Expo. Ending transmissions on September 18 on 3.5–2400 MHz (all modes) were 8J2XPO, 8J7XPO, and 8J8XPO. 8J4XPO and 8J5XPO closed down on August 31, 8J1HAM closed on August 28, and 8J0ATC, which logged 16,561 QSOs with 86 countries in 12 days in April, operated from Niigata for the 9th Asian Tabletennis Championship.

Korea. HL5AP seems still to be QRL, but Steve Bozak HL9VX ("I read your fine magazine all the time and think it's great,") writes that reciprocal amateur licenses are on the way. "All the paper work is in and the wait is on for the government to work out details. [I hope] all will be finished by the end of this year." He reports that packet radio is growing fast, with nodes and gateways on the air linking 10, 20 and 2 meters, mostly near Seoul. About ten operators are on packet. "Listen for us on 14.103 MHz. U.S. west coast has been coming in nightly." [*Thanks for the info, Steve, and we'd appreciate more news from there.—CCC*]

Mexico. The Radio Club de Nuevo Leon A.C., Arq. Javier de la Garza EX2PAG, president, is offering an International Special 25th Anniversary Award for two-way contacts, any authorized band or mode, with any three of the 45 RCNL members, who will be using the special prefix 4C2 instead of XE2 for the valid-contact period, July 24, 1988 to July 24, 1989 inclusive. For award and QSL cards, send by registered mail a list of contacts with date, GMT time, frequency, mode, RST, with QSL cards, US$5 money order, self-addressed 9" x 11-1/2" envelope and IRC, to: Gino Decanini XE2GDD, PO Box 441, Monterrey, N.L. 64000 Mexico.

Togo. Denny 5V7WD writes "From the Shack of the Togo Witch Doctor" that he and Diane (Dennis and Diane Washer) have moved from Kpalime to: Mission ABWE—Aviation, B.P.228, Kara, Togo, West Africa, with the 5-meter-long homemade wooden tower, yagi (with no rotor), TS-430, SB-200, and straight key. They are "set up on 80–10 (including WARC) and looking forward to the first 160 contact." They maintain an informal weekday roundtable with the manager, WB4LFM, on 21325± at 1245 Zulu—all are welcome. The ham population includes Steve 5V7SA and his younger brother, Ron 5V7RW, and a number of transients. "I handle the bureau cards for these hard-to-find folk." He says 40 and 80 have had good openings into

Continued on page 90


MEXICO

THE RADIO CLUB DE NUEVO LEON, A.C.
GRANTS THIS INTERNATIONAL SPECIAL AWARD
TO XE2 NGI op Cristina
BY COMPLYING THE REQUIRED CONTACT WITH THE FOLLOWING STATIONS 4C2 PAG 4C2 ABA 4C2 PPJ
IN THE 25 TH ANIVERSARY CELEBRATION
MONTERREY, N. L. MEXICO December 25th, 1988

4C2 PAG — MEXICO — CONFIRMING TWO WAY CONTACT WITH STATION XE2 NGI op Cristina — 09/18 13:00 7.030 5-9-5 SSB — 73's FROM Javier — REMARKS Regards

4C2 ABA — MEXICO — CONFIRMING TWO WAY CONTACT WITH XE2 NGI op Cristina — 09/20 12:00 14.160 5-8 CW — 73's FROM Ruben — REMARKS Congratulations

4C2 PPJ — MEXICO — CONFIRMING TWO WAY CONTACT WITH XE2 NGI op Cristina — 10/05 1:15 14.170 4-5 SSB — 73's FROM José Antonio — REMARKS Thanks for calling

The 73 International
Universal Permit Application

The following-named radio amateur respecfully requests the permission of the government of ____________________
to operate amateur radio equipment in the country. If permission is granted, I, the undersigned, agree to operate in accordance with *the rules, regulations and conditions established by the permit-Issuing government, by the terms and conditions of the bilateral agreement (If any) between the permit-issuing country and my country, rules of the (ITU) Geneva Radio Regulations governing radio operations, and the rules and regulations of my country. Furthermore, I certify that the following information is true and accurate.*

Full signature: ____________________ **Date:** ____________________

PERSONAL INFORMATION

1. Family Name(s) ____________________ 2. Given Name(s) ____________________

3. Country of Residence ____________ 4. Citizen? ____________ by Birth? ____________ Naturalized? ____________

5. Nationality ____________________ 6. Place/Date of Birth ____________________

7. Home Address ____________________

8. Personal description (If not included on passport or other officai ID attached here—Color hair, eyes, weight, height): ____________

9. Attach photocopies of passport pages showing name, number, and other selected data. (If passport not required for entry, attach photocopies of Birth Certificate and officai ID showing picture—such as Drivers License.)

10. Occupation (profession and place of employment) ____________________

AMATEUR RADIO INFORMATION

11. Callsign ____________________ 12. Operation license number (if any) and class ____________________

13. Expiration date (If none given attach notorized certificate that license is valid) ____________________

14. Attach photocopy of license (If Morse speed not shown, indicate here) ____________________

INFORMATION ABOUT PLANNED VISIT

15. Arrival/permit to be effective date ____________________ 16. Departure/permit end date ____________________

17. Address(es) in permit Country ____________________

18. Location(s) of operation(s) ____________________

19. Description of equipment (brands, models, XMTR, RCVR, XCVR, power amps, antenna(s), power, bands, and types of emissions

____

20. Point and manner of entry of operator and equipment into Country ____________________

50. SPECIAL INFORMATION FOR THIS PERMIT-ISSUING COUNTRY (If any)

51. ____________________

52. ____________________

53. ____________________

54. ____________________

Here is the first revision of the Universal form, 10/88, based on input from PY1APS, OK3CMZ, SV1IW, 4X11MK, I2MQP, JARL, XE1MKT, ZL2VR, CT4UE, SM0COP, BV2A/2B, *and others.* ***Most*** *Countries seem to want the above information; some items have been omitted as rarely required. "Special Information" wanted will be listed elsewhere.*

The next steps: (1) Comments on this from anybody, anywhere; (2) unofficial approval (with added changes?) from you on behalf of your Country; (3) any special information required by your Country which is not listed either on this page or on the "Special Info" list elsewhere in 73 International.

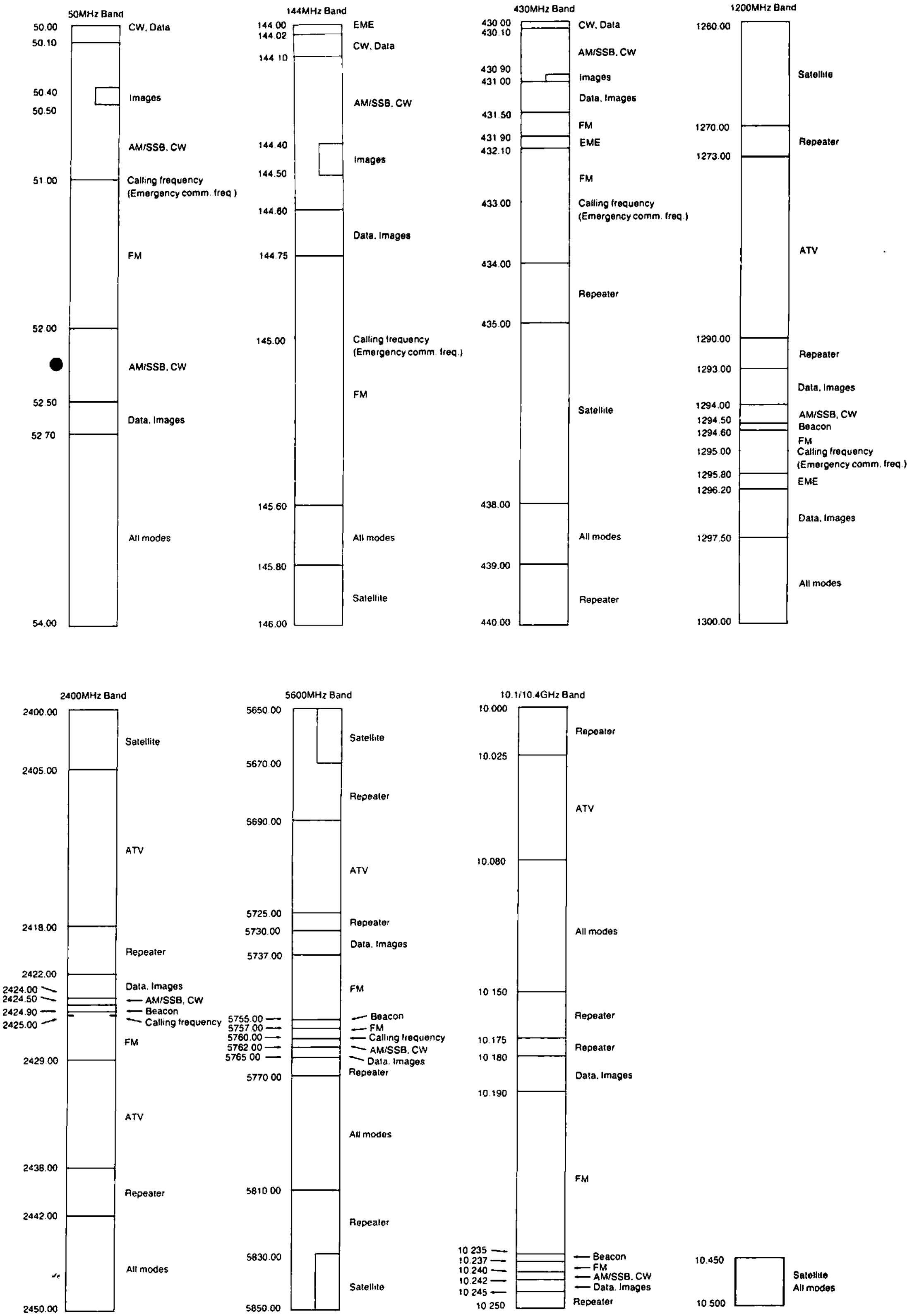
The next revision will be published in about six months–please send us your contributions now–while you are thinking about it. Maybe the next revision will be good enough to send out for official national reaction!

Some "Special Information" for some countries appeared in earlier columns this year; this will be repeated with the next revision of the form, on a separate sheet (or on the back of the form). Meanwhile, remember that you can get forms specifically for Japan by sending us an SASE (SASE with 2 IRCs from outside the US—see April issue, p. 99); and the Italian Association (ARI) has offered considerable assistance to permit-seekers—see May issue, p. 93. Any other national associations willing to provide assistance to permit-seekers, let us know!

JAPANESE (JARL) BAND PLAN

50 MHz .... 10.4 GHz

(To be effective January 1, 1989)



Continued from page 87

Spyros 5B4MF in his shack.

the States around 0600 local time, and the West Coast is good then on 20 meters. Wishes he could get into computer RTTY, and invites "anyone wanting to get rid of a setup [to] throw it this way!" He'll be N4EXB next.

USSR. Last month we gave UA9MA's Oblast number as 168. According to *The "DXNS" U.S.S.R. Oblast Guide* published by Geoff Watts, Editor of the *DX News Sheet*, Omsk is in Oblast 146. The 13-page guide lists and locates on outline maps all 184 oblasts comprehensively and gives contest information. (It can be obtained for 1 U.K. pound, or by airmail for US$3 or 6 IRCs—no foreign checks—the same price as for his 11-page *DXCC Countries Guide* or the 15-page *Radio Amateur Prefix-Country-Zone List*. Write him at 62 Belmore Rd., Norwich, NR7 0PU, England.)

CYPRUS

Aris Kaponides 5B4JE
PO Box 1723
Limassol
Cyprus

Although Cyprus has a large number of radio amateur licenses compared to its population (550 among 650,000), the really active amateurs on the HF bands do not exceed a dozen. One of the most active is Spyros 5B4MF, now 19 years old.

A serious DXer and contester, Spyros came first worldwide in the IARU HF championship last year, using the special call H25MF. I had a short interview with him at the CARS annual meeting, and learned that he started at age 12, in 1980, as a pupil of the English School in Nicosia. He operated from the school club station, 5B4ES, and got his own license in 1982.

5B4MF was third worldwide in the 1983 WPX contest (SSB) on 10, and was in the 10m ARRL contest as 5B4XX. He was 7th worldwide on 15m SSB in the 1984 WPX contest, second in the European DX contest in 1985, using 5B25MF, and operated as P36P in the 1986 CQDX contest and as ZC4DX in the CQDX 1987 contest (with ZC4AP, 5B4SA and 4Z4DX). This year he was H22H in the CQ WPX contest, with 5B4SA and 5B4LP.

Spyros has the DXCC, WAZ, WPX, and got the third 5BDXCC in Cyprus. His station consists of an FT102, FL2100Z, a TH3MKIII tribander, dipoles for 40 and 80 and an inverted-V dipole for 160. Mostly on SSB, he is on CW occasionally. He is now finishing his national service in the army, and this month starts his University studies in England, reading Engineering and Computer studies. He promised to answer any pending QSL cards first!

[5B4JE reports that all Cyprus beacons (5B4CY) of CARS are in very good working order (28 MHz, 50 and 70) and are much appreciated by foreign amateurs.

—*CCC*]

Never Say Die

Continued from page 6

Atlanta was hot in July. Hoo, boy it was hot. Big surprise. I wonder if this is the best time for a hamfest here? On Sunday, after the hamfest fizzled out, Sherry and I headed for the Atlanta Zoo. I understand they're working on getting Atlanta Underground going again. That used to be fun a few years ago—then teenage gangs ruined it.

Discrimination?

Are hams going to wait for some affirmative action legislation before we make an effort to attract minority groups?

How many Chinese, Indian, Black, Hispanic and so on hams have you run into on the air? How many at hamfests? I get to a zillion hamfests and I'll tell you, they are few and far between

For that matter, even in Africa, about 99% of the hams I've met or worked have been White. This is one of the reasons amateur radio has had so little support from the African countries. They see amateur radio as a White man's hobby and the ham bands as billions of dollars of radio spectrum reserved for this tiny White elite to use purely as a playground. I don't think they realize that the Japanese outnumber the American hams about five to one, but they sure realize how few Black hams there are in the world—including all of Africa.

I realize that the long term preservation of our hams bands is not high on your list of priorities—probably right up there with stopping the genocide in Portugese Timor. But the next time you run into a Black who shows even the slightest interest in amateur radio, it's something to feel guilty about if you turn him away.

Our ham bands have been saved at the Geneva ITU conferences twice now through flukes. With one-country, one-vote, the third world can easily upset our applecart. It's only through their lack of cooperation among themselves that we have our bands right now.

Getting back to Atlanta—I want to see every able-bodied southern ham there next year. The South shall rise again—and go to Atlanta.

If you actually did go this year and have any ideas on ways to make the hamfest more fun, drop me a line. They had some fine talks—a big flea market—darned few commercial exhibitors—an amazing bunch of computers and software—must have been at least 30% of the show. I think they'll find a better location than the Omni Center next year.

The May FCC Figures

When I warned that they would be down compared to 1987, I got flack as a doom and gloomer—and wrong. Sure. Heck, wey're only down 56%—no big deal.

W5YI published the FCC figures for the last three years—too bad if you don't subscribe so you could get the bad news early. During the last twelve months the number of new amateur licenses dropped by 21%. June-May 1986/87 was 26,500. June-May 1987/88 wa s 20,893. That's a 5,067 drop. That's 21%. And those are the FCC figures.

In January we were down 47% from last year. If February we were only down 14%. In March the Novice Enhancement seemed to bring 'em out of the woodwork briefly, so we were up 243% over last year. April was down 19% from 1987 and June was a disaster, down a whopping 56%.

If you can see any signs that any approach to getting more hams is working, please advise. I don't see any indication that Novice Enhancement is making any long term changes. I don't see any sign that ham clubs are changing their pattern of ignoring the problem. I don't see any rush from the zillions of Archie comic books the League has distributed. What I see is a growth of 1.5% per year for the last three years—and the possibility that this may be completely imaginary, a figment of the FCC's not really knowing any more how many older hams have died. If 1.5% of the Silent Keys haven't been removed from the FCC's list, even that small growth may be illusory.

In the years after WWII, for seventeen years we had a growth of 11% per year. That stopped 25 years ago. If you've got a computer handy you can check it out—our growth from about 300,000 hams to 437,000 in 25 years comes out to an average growth of 1.5% per year—right where we've been for the last three years. At that rate we'll catch up to where Japan is right now in about 110 years. One thing we know positively for sure: What we've been doing toward getting new hams has been a total flop. Now we know how NOT to do it.

So let's stop with the polyanna baloney and get serious about getting amateur radio growing.

Number 32 on your Feedback card

ERRATA

Corrections

September Cover Credit

We give our very special belated thanks to Mr. Ken Nelson of Oakham, Massachusetts for allowing us to photograph his tower.

Digital Voice Compression—June '88

Refer to page 52. The decimal points between numbers without spaces should be fraction bars. In the first column, paragraph 3, it should read 1/7000; in paragraph 6, 1/30–1/50, 1/7000, 7000/50, and again 1/30–1/50. In the second column, paragraph 1, it should be "1/30 of a second."

Briefly Speaking RS-232—June '88

Refer to page 40. Table 1 had two columns labeled "From DCE" and "To DTE." The second column should have been "From DTE."

The Pee Wee Thirty Transceiver—September '88

Refer to page 33. The image of the circuit board, i.e. folio traces (shown in the lower left hand corner), is reversed.

Simple Oscillator Circuit—June '88

Refer to page 74. A piece of information is missing on the circuit using the 88 MHz toroid. The output is 1 kHz. Also, the purpose of varying the BIOS is to obtain the best waveform. An oscilloscope is required.

Contest results—August '88

Sincere apologies to N4OKX who was incorrectly listed as N4IKX in the results of the 1987 160 meter SSB contest. These results were published in the August 1988 issue on page 74.

Digicom > 64—August '88

Refer to page 22. IC2b, pin 4, in Figure 1 should NOT be connected to pins 6 and 7. Pin 4 is connected to the −5V supply and C12 only. Pin 6 is connected directly to pin 7.

Note also the author's new address:

Barry N. Kutner, M.D. W2UP
614-B Palmer Lane
Yardley, PA 19067

QTH DX Japan—September '88

Refer to page 89. The number of hams in Japan, the ratio of hams to Japanese residents, and the per-residents comparison with hams in the United States were stated incorrectly.

There are 1,608,128 amateur licenses in Japan, according to the Japanese Amateur Radio League. That's equivalent of one ham for every 75 Japanese residents, more than seven times the United States ratio of one ham for every 544 residents.

We reported there are 33,043 hams in Japan, the number given in the 1988 *Radio Amateur Callbook*. However, that figure includes only those Japanese hams whose calls are reported to the *Callbook*. Based on that figure, our article mistakenly stated that one out of every 3,674 Japanese residents is a ham, and incorrectly noted that ratio as about one-seventh of the ratio of the United States.

Continued from page 11

program, and called up Gerry's new digital picture. There it was, a PSTV image of an attractive young lady with the message "FROM WB8RNY" hanging just below her chin. For the second time that evening, I leaped straight up from the chair and let out a hollar.

My wife banged on the floor upstairs. "Are you all right down there?" she wanted to know. "Better than that," I shouted. "Take a look at this." In her own special way, she studied the picture on the screen. "Nice," she mumbled and headed back upstairs. Translating that from XYL jargon to ham lingo, she was as impressed as I was.

With the error-free capability of packet radio, Packet Scan Television pictures like this can be transmitted over long distances (literally worldwide when band conditions permit). The only requirements are that both users have the appropriate software to create and display the images, and that the pictures be prepared in advance.

Improvement Ideas

That last problem could be taken care of nicely with a software modification, written especially to send the digitized information directly to the packet TNC as it becomes available, or on command. This would require a second port on the computer, however (one for the digitizer and one for the TNC). The C-64 contains additional ports for the cassette drive and joystick, one of which could be used to drive the TNC.

With higher packet baud rates, such as may be used on UHF frequencies, it would also be possible to speed up the transfer so that each picture could be transmitted as soon as it is available (about one picture every 2.8 seconds with the Kinney system). This is a project for future study.

In the two years in which I have had a TNC, packet radio has provided me with many pleasures, including rag-chewing, traffic handling for the National Traffic System, computer program transfers, and now "Packet Scan Television." This latest application of packet radio may be slow and take a bit of planning, but it sure works well and results in a perfect copy of the original picture which appears at the other end.

The growth of Packet Scan Television is now in your hands. If you are intrigued by this new mode, give it a try. If you have some creative experiments in mind and are looking for a willing partner, get in touch with me via the WA8OOH PBBS in Livonia, Michigan. My mental buffer is open to your suggestions. ■

Footnotes:

[1]Kinney Software, 974 Hodsdon Road, Pownal, Maine 04069

[2]Versions of the circuit and software are available for other computers also. Consult Kinney Software for details.

[3]Print Shop, written by Broderbund Software and copywritten by Pixellite Software, is readily available at most computer stores or mail order houses.

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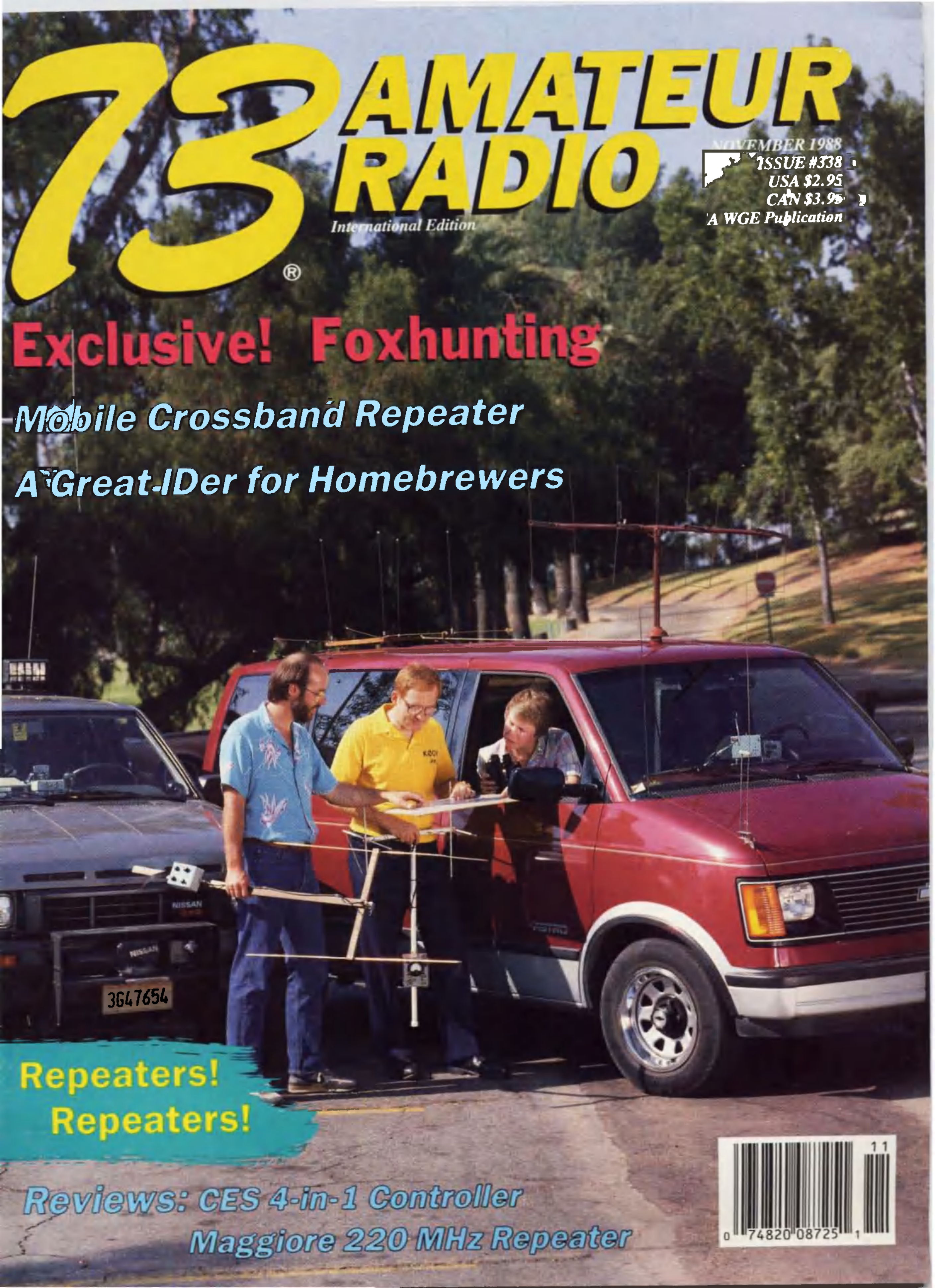

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Repeaters! Repeaters!

Reviews: CES 4-in-1 Controller

Maggiore 220 MHz Repeater

11
0 74820 08725 1

Welcome, Newcomers!

REPEATERS

Do you recall the Radio Shack walkie-talkies with which you could talk to someone up to a quarter of a mile away? Maybe this thrill led some of you to become involved in CB, where it was possible to talk with someone from you car reliably at a much greater distance—even 15–20 miles! It never fails to intrigue a non-ham friend of mine, however, when, using a hand-held radio no larger than one of the walkie talkies mentioned above, and putting out as little power, I communicate with someone *halfway across New England*—and with superb signal quality. And it's all due to an invention that moved onto the ham scene twenty or so years ago—the repeater.

A repeater's basic function is to receive a signal and rebroadcast it simultaneously. It is most useful for line-of-sight signals—those that travel in a straight line. These signals are usually FM for repeater use. The range of direct communications using line-of-sight signals, however, is limited due to the Earth's curvature and large obstructions, such as mountains. A repeater, especially when placed in an area that gives it a great range, such as on top of a mountain, can increase a line-of-sight signal's range by two or three times.

Imagine now linking two or more repeaters together. The range is then limited only by the number of repeater linkages. I often use a network of 14 repeaters located throughout New England, the 220 MHz repeater network, that allows repeater users to talk with hams from New York City to Montreal—over 400 miles apart! Networks like these are sprouting up all over the US, and gaining popularity in many other parts of the world.

Repeaters are quickly showing that the sky's the limit now with line-of-sight FM communications!

de NS1B 73

GLOSSARY

Autopatch - A device that weds a repeater system to the telephone system. This allows ham communications at the repeater to enter the telephone system.

Breaker - A ham who interrupts a conversation on the repeater, often to ask the current user's permission to make a brief call.

Channel Pair - The input and output frequency pair of a given repeater.

Closed Repeater - A repeater not open to general access.

Control Operator - The ham designated to police the repeater. He or she can activate or deactivate any of the functions, and even shut down the repeater. They control it either locally, or more commonly, remotely.

Courtesy Tone - That tone that sounds after a user ends a transmission and releases the Push-To-Talk button. This helps other users know when a user has finished transmitting.

Crossband - Communications on another amateur band though a link interfaced with the repeater.

Desense - Corruption of receiver sensitivity due to swamping the repeater receiver with overly strong signals.

Duplexer - A device usually made up of one or more pairs of large metal resonant cavities. It Is fed with three transmission lines: one each from the repeater receiver and transmitter, and one from the antenna. It serves to separate the incoming and outgoing signals that flow simultaneously through the antenna system, preventing receiver desense.

Full Quieting - A received signal that is so strong that it entirely masks the ambient noise on its frequency.

Half-Duplex - This describes communication that takes place on two frequencies, with one as only the receive state, and the other as only the transmit state, at alternate times. Repeater operations are half-duplex. Telephone communications are full-duplex; they allow simultaneous transmit (talk) and receive (listen) states.

Handheld - Also known as handy-talkie, or HT. A transceiver small enough to be held in, and operated with, one hand.

Input - The repeater receiver frequency. This is the frequency a repeater user transmits on.

Intermod (IMD) - The result of the mixing of one or more undesired signals with a desired signal in the first RF amplification stages (front end) of a receiver.

Key-up - Causing a repeater to transmit by transmitting on its input (receive) frequency.

Kerchunk - To key up a repeater without modulating the input signal (such as by speaking into the rig). "Kerchunkers" are those who, usually unnecessarily, key up a repeater many times.

Offset - There are two common meanings for this word here. The first refers to the spacing between the input and output frequencies on a repeater or other transceiver. The spacing and the offset is standardized for most bands.

The second refers to the control on a rig that sets the input and/or output frequency to a point between the standard frequency steps of that band. For example, 2 meter synthesized FM rigs step through frequencies in 10 kHz steps, and most repeater channel pairs are located on these increments. Five kHz is a common offset adjustment on these rigs.

Output - The frequency on which the repeater transmits. This is the receive frequency for a transceiver of a person using the repeater.

Picket-fencing - Rapid flutter on a mobile signal resulting from multipath fading. This oftens occurs in urban areas where signals collide off buildings.

Polarization - An electromagnetic wave has two planes of energy—the electric field plane (E-plane) and the magnetic field plane (H-field). These planes are perpendicular to each other. Polarization refers to the orientation of the E-field; either parallel to the Earth's surface (horizontally polarized) or perpendicular to the Earth's surface (vertically polarized).

Repeater antennas are usually vertically polarized, because the antenna systems of most transceivers that use repeaters—such as whips mounted on car roofs or hand-held radio antennas—have the same polarization.

Reverse Autopatch - This is a device that, like an autopatch, weds a repeater system to a telephone system. This allows a telephone user to initiate radio communications through the repeater.

Simplex - Communications via only one frequency.

Split Sites - Refers to a repeater system that has separate transmitter and receiver sites, and are connected either by radio or by telephone lines. These systems don't require a duplexer since the transmit and receiver posts use different antenna systems, and are sufficiently far apart to prevent repeater receiver desense.

Squelch Tail - The noise burst that follows the short unmodulated carrier following each repeater transmission.

Timer - A control in the repeater that shuts down its transmitter after a continuous input exceeds a preset time limit. This keeps long-winded users from tying up the machine. The time limit is usually set at 1½–3 minutes.

Tone Pad - Also know as Dual-Tone Multiple-Frequency (DTMF) pad. It generates the standard telephone system tones that control various repeater functions.

QRM

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Peterborough NH 03458-1194
phone: 603-525-4201

Advertising Offices
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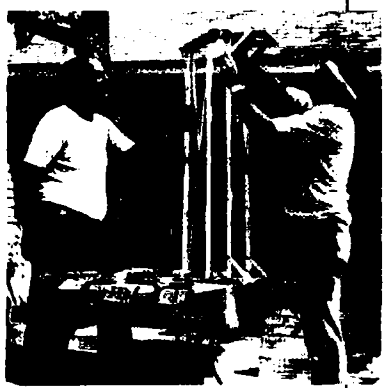

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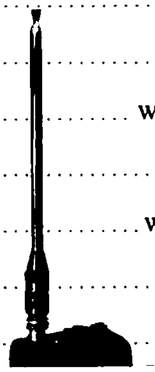

BOOK REVIEW

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FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

Cover photo by Tom Curlee

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Life After Death

It's only by accepting the FCC figures on ham licenses at face value that we have the appearance that amateur radio is growing at about 1.5% per year. But just how accurate are those figures? Alas, the answer is: not very.

I'll accept that the FCC's computer is able to keep pretty good track of the new licensees and upgrades. I've no complaints there. But it's only by trying to maintain the fiction that hams, unlike other people, do not die, that the FCC is able to make it look as if our numbers have been significantly growing.

The hole in the FCC fabric is a big and obvious one. They have no mechanism for finding out when our smoking, drinking, overeating, and lack of exercise of anything but our jaw, volunteers us for that last glorious mention in *QST*: Silent Keys. The result is that, like Chicago voting lists, deceased hams are carried on the FCC's books for up to ten years, making the numbers look substantially better than they are.

How much? Well, we can't tell exactly, but even if we only go by the full page Silent Key lists in *QST*, we know there's a bunch. One way to get a handle on the FCC's ghostly inflated figures is to check with insurance company actuarial tables and see about how many hams are, on the average, dying every year.

Some estimates of the average ham age are as high as 59 (that I believe), and some are as low as 50 (that is much more difficult to believe). Anyway, let's look at the actuarials for 53 and see what that does to the FCC figures. At 53 we can expect 10.1 deaths per thousand. The FCC says we have 435,000 licensees, which would lead us to expect 4400 ham gear sales by ham widows per year. Since the FCC takes ten years to discover that a ham is either operating on a completely new wavelength or has lost interest in the hobby, we could have as many as 44,000 phantom hams. And that doesn't count those semi-live hams who have lost interest in the hobby and have no intention of becoming active or even renewing their ticket. I constantly run into ex-hams at electronic shows, so I know there are a lot of them.

We know that less than half of the licensed hams are active, so if half of the remainder drop out when renewal time comes along, we could be losing several thousand more a year.

Anyway, the bottom line is to take those rosy figures showing ham growth with a big dose of salts. Hello *QST*, are you reading this?

So, okay, the 54% drop in new licensees in the last four years has been made to look like less of a disaster by a bit of fiction. So what's the harm? Well, one harm is that a depressing number of old time hams believe the fiction and believe the pollyanna *QST* reports of all being well. If things are going well, let's ignore doom and gloomer Wayne—boo on Wayne and his anti-code baloney. He's just hot air—trying to sell more subscriptions to his lousy rag. He's just trying to get rich off us old timers.

Get rich, eh? I'll tell you what, if there are any wealthy hams out there who are interested in a deal, here's one to think about. If you'll guarantee to cover any possible *73* losses each year, I'll guarantee you can have all the profits. Now doesn't that sound like a great way to make a mint fast? Get down off that turnip truck and give me a call. News flash for you: there's only one ham magazine making big profits and that's *QST*—they have millions salted away for a rainy day. How hard does it have to rain for them to start actually doing something to get amateur radio growing? And I'm not putting down the ARRL, I'm putting you, the members, down for not saying word one. As long as you aren't the least bit interested in what they do or in get-

Continued on page 84

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Reallocation

"Amateur stations may continue to use the 220–222 MHz band until Private Land Mobile and government users are allowed access. Amateur operators are cautioned, however, to refrain from making any investment in equipment suitable for operation only in this band. Amateurs should begin an orderly transition of ongoing operations in the 220–222 MHz band to other amateur service frequency bands so that an abrupt termination of such activities will not be necessary."

That was just one of the summary conclusions from the text of the Report and Order on General Radio Docket 87-14, that, among other things, orders the transfer of 220–222 MHz over to use by land mobile interests. The 10-page document issued 6 September, closely paralleled the FCC Press Release of 4 August.

As a part of the same concluding statement, the Report and Order hinted that the FCC is aware of the hardships the reallocation will cause to current 1¼ meter amateur operations:

"...the amateur community may wish to address any changes to the amateur rules it finds desirable in preparation of the removal of the 220–222 MHz band. For example, the lifting of the prohibition on auxiliary link operation on some of the longer wavelength bands and the placing of a prohibition on repeater operation in a portion of the 222–225 MHz band are two matters the amateur community may wish to consider and petition for amendment."

For a fuller discussion on the reallocation of 220–222 MHz, see this month's "Looking West."

Microsat

The AMSAT-NA Microsat project took a big step forward in late August when accurate models of the generic satellite passed a rigorous series of shake and vibration tests. The tests subjected the Microsat bus to vibration levels much higher than those to which AO-13 was subjected.

According to W3GEY, the prototype Microsat passed the tests with flying colors. Acceleration levels over 14 Gs in the vibration test and over 44 Gs in the shock test caused no problems for the rugged microsat bus. The tests were performed at Utah State University in Logan.

For those not aware of this project, AMSAT-North America (AMSAT-NA) President Vern Riportella WA2LQQ announced plans on 30 July to launch four microsatellites from a single European Space Agency (ESA) Ariane launch vehicle. These satellites are truly small, measuring only 9" cubed and weighing only 22 lbs. Two of these microsats are planned as "Pac-Sats"—store and forward packet satellites. AMSAT-NA and AMSAT-LU (Argentina) will each operate one of the Pac-Sats. The other two birds will be special purpose amateur satellites. One is being sponsored by Brazil AMSAT (BRAMSAT), and will carry DOVE (Digital Orbiting Voice Encoder) This satellite will carry a synthesized voice transmitter. The final satellite is sponsored by the Center for Aerospace Technology (CAST) at Weber State College of Ogden Utah, and will carry a low resolution camera.

Writer's Guides

Warm up your pens, typewriters, and word processors! The new *73 Magazine Writer's Guide* is ready for distribution. Along with that goes a sheet with pointers on shooting photos you would like considered for the cover of *73*.

Compuserve and GEnie users will be happy to know they can download the Guide to their systems. Of course, you can obtain a hardcopy of the Guide via conventional mail at the address listed at the end of this column. Send your request to the attention of Martha Gouse.

Space Hotline

A new dial-up voice space news service is on line. The Space Activities Hot Line (SPACHL) carries the very latest news on amateur radio satellite operations, related radio nets, and general world space activities.

The five-minute recorded announcement carries details of times and frequencies. It might be a good idea to record the bulletin since it flows quickly and gives many details and numbers.

An added special feature of SPACHL is the SPACHL Technical Service. OSCAR users can get free technical advice on getting their stations running and keeping them in top shape. Simply dial the SPACHL number and, at the tone, leave a short message indicating your name, callsign, telephone number, the time of day you would prefer to be called and the nature of the problem. An expert in that field will call you (collect) within a week to give free guidance on getting your OSCAR station operating or on other related problems.

This service is so far available only in the US and Canada. The number to call is (914) 986-3875. SPACHL will be available 24 hours/day. Bulletins will be updated daily. SPACHL is a private, volunteer service provided by WA2LQQ.

17 METERS

On 1 September, the FCC released PR Docket 86-467 that proposes the opening of the 17 meter band for amateurs in the United States. The rule-making procedure will lay out the band plan. The docket proposes giving amateurs access to the entire band, 18.068 to 18.168 MHz, with a 42 kHz CW/Digital emissions subband from 18.068–18.110 MHz. The balance of the band would be for phone, FAX, and television emissions of the types authorized for use below 30 MHz. According to the Commission proposal, only General class and above licensees would have access to 17 meters. Power limitations would be the same as for other high frequency amateur allocations.

The final acts of the 1979 World Administrative Radio Conference allocated 18.068 to 18.168 MHz to the amateur and amateur satellite services. Normally a two-step process follows on a domestic level after such an allocation is made internationally. The FCC took the first step by amending the domestic Table of Allocations to add 17 meters to the amateur services. The second step—the issuance of this NPRM—awaited the removal of the government-fixed services from the band. These operations must cease no later than 1 July 1989.

Ham Call Directory On Packet

This is an ideal system for packeteers who don't have the Callbook. Jim Dearras WA4ONG of Richmond VA has a database of US ham addresses up to December 1987 resident on CD-ROM which he has interfaced with his PBBS. They may be addressed by a simple packet radiogram. The callsign info is from Buckmaster Publishing and is stored on CD-ROM.

There are two ways to access address information. If you're local to the BBS (145.01 MHz), simply type in "OS OTH (desired callsign)." The address will usually appear on your home PBBS. You can ask for multiple addresses by separating callsigns with a space or comma.

Non-local users should log on to their local BBS and send "SP REQQTH @ WA4ONG." When the PBBS prompts you for the title, type in the calls of the desired addresses, again separated by spaces or commas. At the end, put an @ and then your home PBBS call to allow the WA4ONG PBBS to forward these messages.

The HF gateways for this system are WB0TAX Hampton VA, and W3IWI in Maryland, both on 20 meters. Packeteers as far away as Australia have obtained addresses through this system!

Thanks . . .

to ***Westlink, Gateway, Chattering Relay, The BirmingHam,*** and **WA6WZO for furnishing this month's news items. Keep your ham-related news items and photos rolling in to *73 Magazine*, 70 Rte. 202 N, Peterborough, NH 03456-1194. Attn: ORX.**

Number 9 on your Feedback card

73 Review *by Peter J. Bertini K1ZJH*

The Maggiore Hi Pro Basic Repeater

Maggiore Electronic Laboratory
600 Westtown Road
West Chester, PA 19382
(215) 436-6051
Price: $1,001

High quality repeater at a reasonable price.

My club, the Mt. Tom Amateur Repeater Association, made a commitment to put a 220 MHz repeater on the air. It seemed improbable, however, with only $1500 in hand to cover the costs of the repeater, duplexer, and antenna. The club was already supporting three two meter machines, and with our 220 MHz amateur allocation in jeopardy, few members were willing to risk a large personal or club investment.

Then we noticed an ad from Maggiore Electronics Laboratory (MELCO) in an issue of *73 Magazine*. A phone call brought quick results. Within a few days, we received Maggiore's latest catalog in the mail. Another phone call to Frank Maggiore was equally productive—yes, we could buy the Maggiore Hi Pro Basic repeater (their lowest-priced repeater) without the internal power supply. And yes, we could have the optional 25 watt PA and HPC201 microprocessor controller/autopatch installed.

The price seemed too good to be true. Half-heartedly, I mailed the check and rationalized to myself, "Even if it only runs a year and croaks, the club will then be in a better position to replace it with a 'known' brand." That was over three years ago with faultless service.

Simple and Direct

The Hi Pro Basic isn't much to look at. Its front panel is void of light shows, controls, or even a power switch! The Maggiore Basic repeater packs into a tiny 11-pound package.

The COR1 identifier and timer board come with the Basic package, but I suggest you consider substituting them with the optional HPC201 microprocessor controller/autopatch. *(See the HPC201 review in a future issue.)*

The Basic repeater is normally supplied with a 15 watt transmitter. The repeaters shipped with one set of crystals, tuned and ready to run.

Transmitter Performance

Two of our two meter repeaters, a GE Master Pro and a Spectrum 77, are also using 30 watt transmitter assemblies from Maggiore. This represents several years of aggregate service on busy wide-area coverage repeaters with no transmitter failures to date. One nice thing we quickly noticed about these transmitters is their ability to make rated power output at the specified DC supply voltage.

Power sag—a common repeater woe— is the annoying tendency for power output to slowly fall off after a transmitter has been on for a while. It can be caused by inadequate heatsinking, poor design, or both. The repeaters are monitored daily with commercial service monitors and the long-term frequency stability has held within a few hundred cycles on all of the transmitters.

The 220 MHz repeater is running a Wacom WP-652 duplexer (Maggiore Electronics) and a Falcon MOSFET repeater power amplifier at 70 watts output. A Hamtronics GaAsFET preamp is also being used on the receiver. No measurable desense was found with the higher power levels.

Our three two meter repeaters now using the 30 watt Maggiore transmitters drive bipolar power amps with power outputs in excess of 100 watts. The repeater receivers are also using preamps. As with the 220 MHz system, no problems with receiver desense was noted, thanks to the absence of transmitter noise.

None of the transmitters showed signs of instability when operating into the reactive loads which duplexers can present, or when driving external power amplifiers. Tuning is smooth, with no unusual power jumps or other anomalies. A Cushman CE-15 spectrum analyzer verified that the transmitters were clean and free of spurious output.

The EV-1 exciter is rated at 4.5 watts output continuous duty; optional power amplifiers are available from 15 to 40 watts. The power amplifier mounts in the die-cast aluminum housing with the exciter. Power output may be set via an internal drive control. The EV-1 transmitter is used in the two meter and 220 MHz repeaters.

The R4V Receiver

The Maggiore R4V VHF receiver is dual-conversion design, using 10.7 MHz and 455 kHz first and second IFs. A six-pole monolithic crystal filter follows the first mixer. A Murata E ceramic filter (5.5 kHz bandwidth) at the lower IF frequency really sharpens things up. There's a Murata F Filter with a 4.5 kHz bandwidth available for those repeaters plagued by extremely strong signals on adjacent 15 kHz channels. Another two-pole 10.7 MHz filter can be added. Both of our Basic repeaters have the six-pole filters and the 5.5 kHz Murata filters. The Maggiore receivers are FCC certified for commercial use.

Dual-gate MOSFETs are used in the RF and first mixer stages. Five top-coupled LC stages provide good RF selectivity at the operating frequency. A third-overtone crystal in a bipolar oscillator, followed by a bipolar tripler stage, generates the desired LO frequency for mixer injection. The remaining receiver circuitry uses ICs. The R4V receiver is used in the 144 MHz and 220 MHz repeaters.

R4V receivers do not have the problem of the squelch breaking in the presence of electrical noise, such as from lightning discharges or power lines. Sensitivity was best with the receiver squelch set at its threshold. Once set, the squelch is stable.

I mentioned earlier that we use Hamtronics GaAsFET preamps on our receivers. The R4V receiver has a hot front end, and unless the repeater is located in an extremely quiet RF environment, I doubt you will note the difference. If you must use a preamp, the Hamtronics repeater preamp is your best bet for several reasons: they have fairly low gain (about 10 dB) and use sharp helical resonators. You might be surprised by how many repeater receiver problems can be caused by preamps!

The documentation for the Maggiore Hi Pro Basic repeater is adequate. Separate booklets cover each repeater component. Parts lists, schematics, alignment, and general technical information are provided. The repeaters are well made, the PC boards are mil-spec G-10 glass-epoxy, and the board layouts are clean and uncluttered. The receiver and transmitter are housed in rugged die-cast aluminum enclosures, and all signal and power feeds are via feedthrough capacitors. The parts are generic and most are readily available.

And, last but not least the customer support is excellent! The Hi-Pro is a fine bargain.

73 Review *by W. Max Adams W5PFG*

Raise the Hazer!

Glen Martin Engineering, Inc.
Rt. 3, Box 322
Boonville MO 65233
Price Class: $278 (Model H-4HG)

No longer go out on a limb to work on your beam.

What's the big deal about this odd triangle-shaped frame? Well, the Hazer can lower your antenna farm for ground work, which is enormously convenient and a great relief to a cowardly tower climber like myself! What follows is a review of a model of this intriguing piece of equipment, the Hazer Model H-4HG.

The Arrival

The UPS man delivered a couple of boxes from Glen Martin Engineering, both packed in conventional heavy duty cardboard. The smaller one measured 15" x 16" x 10" and the other was a 6" sided triangle shaped box 46" long. Inside the small box was assorted hardware, a smaller box, and a single sheet of instructions.

The Instructions

The front page outlines the three assembly steps: the construction of the Hazer around the tower, the fastening of the winch on the tower at an appropriate level, and the installation of a wire rope pulley. Eight notes followed the steps offering some obvious, and a few not-so-obvious, precautions. The next paragraph described assembly and testing instructions.

The back page has a detailed homebrew drawing of an assembled Hazer complete with item numbers matching a nearby part list, and several detailed sketches of various assembly procedures. The assembly team—Jim Blankenship N5KYO, Stew Wells K5PWD, Glen "Blackie" Blankenship KD5LM, and myself—found these instructions to be quite adequate.

Assembly

We assembled the three Hazer side parts separately. Two side parts were connected with #2 lugs. The rotor and thrust bearing plates were loosely attached to one of the side parts—bolts were installed with their threaded end facing downward. The two-part assembly was placed around the tower, just above the house bracket, with the rotor and thrust bearing plates on the side opposite the house. The third side part easily fit the two-part assembly and was fastened with #2 lugs. We periodically checked clearance and alignment while tightening all bolted joints.

Pulley bracket assembly was first thing we installed on the Hazer side, near the top section tube skirt. This location caused the wire rope to rub on the top (horizontal) Z-brace, a less than desirable condition. Installing the pulley bracket on the Z-brace eliminates rope/tower friction and prevents binding caused by top Z-brace interference when raising Hazer to its maximum height.

Winch installation presented only one minor problem—because of double thick construction across one pair of its mounting holes, the U-bolts provided were about ¼" short of filling the nut threads. A right angle grinder, with metal cutting disk, reworked the tower leg saddle clamp to provide an additional ¼" of thread exposure. Otherwise, winch mounting went smoothly. The stiff 3/16" wire rope presented a problem. Wrap the cut end with plastic tape, and form a kink near the end. This prevents fraying and makes installation of its hold-down clamp easier. Do not attempt to cut the wire rope with ordinary diagonal pliers—use a bolt cutter or other similar tool.

Operation

Using the Hazer is a piece of cake. A spring loaded safety latch engages each Z-brace (horizontal portion), when raising the assembly. Loosening the winch slightly, after the latch engages the last Z-brace, transfers the entire Hazer/Antenna assembly load to the Z-brace. Since the mast center line is only 3-½ inches from the tower face, side loading is much less than one "skinny" tower climber! When lowering Hazer and the antenna assembly, a nylon pull cable releases the latch, one Z-brace at a time. The assembly, accidentally dropped, falls less than one foot!

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Photo A. Rotor and thrust bearing plate assembly on two of Hazer s side parts.

Photo B. Hazer rope wire pulley assembly installation at the top of the tower. We installed the Hazer during the tower installation.

Number 5 on your Feedback card

73 Review *by Pete Putman KT2B*

Kenwood TM-221A 2 Meter FM Transceiver

As user-friendly as the TR-7400A— with more power out in a smaller box!

Kenwood USA Corp.
PO Box 22745
Long Beach, CA 90801-5745
(213) 639-4200
Price: $440

I had so much fun using the TM-221A in the car that it was hard to take time to write it up! This is one of the more user-friendly two meter transceivers on the market today—the beauty of its design is the overall simplicity. This is very welcome in this day of bells, whistles, foghorns, CRTs, readouts and 5,000 plus knobs and whatever else one finds on "full-featured" rigs.

The TM-221A.

Worthy Replacement

For many years, my tried and tested two meter radio was also a Kenwood of 1978 vintage. Many readers will recall the legendary TR-7400A that set the two meter crowd abuzz with full 800 channel synthesis, a super-selective receiver, and more than 25 watts output. In that time of rock-bound rigs, the design was truly state-of-the-art and user-friendly—controls were kept to a minimum, reflecting the demands of mobile operation. Since then, numerous two meter mobile transceivers appeared on the market, flourished briefly, and disappeared. All sorts of crazy options such as remote control heads, continuously adjustable output power and umpteen-million scanning speeds had their day. Meanwhile, the 7400A performed yeoman service in four different cars without one day of downtime.

And yet. . . I found myself thinking how nice it would be to have something smaller under the dash that didn't use power-hungry TTL technology. . .that didn't have its display wash out in bright sunlight. . . and that would allow storage of a few memories, say just 10. About that time, the ads for the TM-221 caught my eye. Ten years to the month that I bought my 7400A, I departed a hamfest with a brand new TM-221 under my arm.

The photo of the TM-221A shows the simple control layout. Here is a package installable virtually anywhere in your car or shack! It measures 5½" x 1½" x 7½", and weighs a mere 2.6 pounds. But, at over 40 watts, there's plenty of punch in that box. . .more than enough for 90% of all mobile FM needs. Front panel switches and knobs adjust volume, squelch, power on, HI/LO power, and dial tuning. Additional pushbuttons select either memories or the VFO, input memory data, and allow high-speed tuning with the main knob in MHz steps.

Five more pushbuttons are located under the frequency display, tucked out of the way until needed. They are (in order): SHIFT (for repeater offsets), REV (to listen on repeater inputs), SCAN, CTCSS (selects receiver subtone frequency), and TONE (selects transmitted subtone frequency). That's it! No other buttons to push, dials to turn, switches to set . . . a piece of cake.

One handy feature of the TM-221A is automatic repeater offset selection, based on the current ARRL two meter band plan. As you tune up from 144 MHz, the "correct" repeater offset automatically kicks in, depending on your position in the band. For example, simplex operation is selected from 144 to 145.10 MHz. From 145.10 to 145.5, the transmitted signal will offset −600 kHz from the receiver frequency. Above 145.50, simplex operation is again selected to 146.00, where an offset of +600 kHz kicks in. The procedure is repeated for all segments through 147.99 MHz.

In everyday use, you'll probably select favorite repeater or simplex frequencies that are stored in memory positions 0–9. Each channel stores not only the frequency, but offset, subtone and tone squelch information as well. In virtually all cases, 10 memories are more than adequate for normal operation. The TM-221A, however, also has 4 additional positions that are special function memory channels. Labeled A–D, these store upper and lower band limits for scan functions as well as non-conventional repeater offsets.

Kenwood kept the scanning functions simple as well. There are only two modes, (all that are usually necessary): Programmable Band Scan, where the upper and lower limits of the scan are entered into memories A and B, and Memory Channel Scan. One scan feature gaining popularity is channel lock out in a memory channel scan. Kenwood includes it here.

The supplied microphone is the MC-48 TouchTone microphone, that looks like a black version of the MC-46. One nice variation from the older MC-46 is that the PTT line must be keyed in order to transmit tones. On older microphones, the keypad was always active, and merely squeezing the microphone tightly often resulted in very interesting transmissions.

Performance

I spent almost three hours installing the radio in a 1987 Toyota Corolla LE in an attempt to create a low-profile and safe installation. The final resting place is inside a

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TM-221 Manufacturer's Specifications

Specification	Manufacturer's Claim	
Frequency Range	(Transmit)	144.000–148.000 MHz
	(Receiver)	138.000–173.995 MHz
Power Output	High	45 Watts
	Low	5–30 W adj.
Current Drain	TX High	9.5 A
	RX Squelched	0.4 A
Receiver Sensitivity	(0.16 µV for 12 dB SINAD)	
Receiver Selectivity	−6 dB/ > 12 kHz	−60 dB/ > 26 kHz
Audio Output	5% distortion	> 2 watts @ 8Ω
Weight	1.2 kg (2.6 lb)	

73 Review *by Robin Rumbolt WA4TEM*

The CES 510SA-II Enhanced Telephone Interconnect

Communications Electronics Specialties, Inc.
931 S. Semoran Blvd.
Suite 218
Winter Park, FL 32792
(800) 327-9956
Price: $583

A solid 4-in-1 controller.

The CES 510SA-II is an automatic microprocessor-controlled telephone interconnect (autopatch) that provides telephone access to mobile and portable radios operating in simplex, half-duplex, and full-duplex modes (see sidebar for explanations of these modes). But it's more than an autopatch. With built-in ID capability, it can operate as a repeater controller, and has provisions for limited remote control of external devices as well.

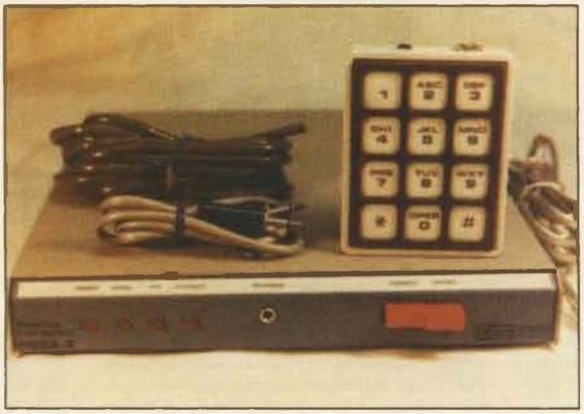

Photo A. View of the Smartpatch II with enclosed DTMF encoder and hookup cables.

Out Of The Box

The first thing I learned about the **Smartpatch II** was that you have to be careful not to drop it when you open the shipping box, or you could be limping around for a while. It's enclosed in an expensive looking 16 gauge steel cabinet that weighs almost four pounds!

Also packed with the interconnect, I found a DTMF (Touchtone) encoder for programming the unit, three cables, and a 27-page manual marked "Preliminary" that had a picture of an earlier version patch on the front cover.

After unpacking, I immediately grabbed a screwdriver and took the cover off the patch. You need to do this to make the connections since there are no rear panel connectors. You have to run the connecting cables through a cutout in the rear panel to a screw terminal block inside the unit.

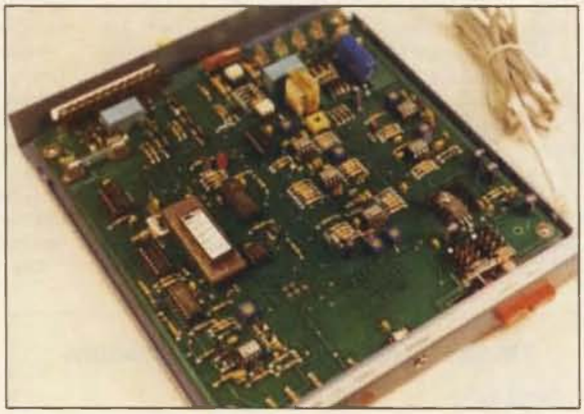

Photo B. Inside view of Smartpatch II.

Inside is a well laid out, double-sided circuit board with a lot of trimmer potentiometers and jumpers. More about those later. There was no silk screen on the board, but various components were identified by lettering etched in the copper itself. I found it interesting that none of the ICs were labeled. (U1, U2, etc.) The manual, however, has a parts layout diagram that serves this purpose.

I always like to look at the bottom of boards for "OPS" components and jumpers. These usually are extra parts added to correct problems found after the PC board has been made. There was one jumper and seven components on the bottom of this board.

The front panel of the interconnect sports four indicator LEDs—POWER, NOISE, PTT, and CONNECT—and two push button switches, POWER and CONNECT. The PROGRAM jack in the center of the front panel accepts a DTMF programming pad connection. See Photo A.

The Circuit

The brain of the CES 510SA-II is a MOSTEK 38P70 microprocessor. This is a piggyback type of micro in which the program ROM plugs directly onto the top of the microprocessor itself. It's an expensive way to go. This minimizes board space and complexity, however, and eliminates several memory interface components. Also, it makes it easy to upgrade software later. A watchdog timer automatically resets the processor should some type of glitch send the processor wandering off into never-never land. There is also a Power-On Reset (POR) circuit to get the micro started properly when power is applied.

Customer programmed parameters are stored in an 8 pin, XICOR 2404-type 512 byte EEPROM. This EEPROM can hold data even with power removed, and can be easily erased and reprogrammed electrically without using ultraviolet erasers and expensive EEPROM programmers.

The Smartpatch II uses the powerful CMOS chip, the MITEL MT8880 DTMF transceiver, for decoding and generating touchtones (DTMF). It has an onboard call progress tone filter which detects various phone line signals, such as dial tone, busy signals, etc. It also has a microprocessor bus interface. Quite impressive for a 20 pin chip! The 510SA-II uses all of these features.

The phone line interface consists of a hybrid transformer coupler circuit for full duplex operation. The traditional holding coil is replaced by a three-transistor current sink circuit. Optically isolated ring detection and "off hook" detection circuits are included. Diode bridges eliminate polarity sensitivity when connecting

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Homing In

Track down one of amateur radio's hottest pursuits!

Joe Moell, P.E., KØOV

Do you think you've done it all in ham radio? If you've never been on a hidden transmitter hunt, you may have missed some of the greatest excitement a ham can have.

This column will help you get in on the fun.

Radio direction finding (RDF) has been around about as long as radio itself. At the turn of the century, Hertz and Marconi developed directional antennas to funnel signals longer distances. Then they discovered that they could use these antennas to determine the direction of incoming signals. RDF pioneers, such as Bellini, Tosi, and Adcock, soon developed specialized receiving antenna systems that gave even more accurate directional indications.

In its infancy, RDF was used as a navigational aid. A ship's operator took bearings of known shore stations to determine their own location. During World War I, RDF techniques were used for the first time to locate clandestine transmitters, in this case, of enemy ships.

This second kind of RDF is what most hams are interested in. For forty years or so, hams have held hidden transmitter hunts. One or two hams take a station to an unlikely spot and make continuous or intermittent transmissions. Usually, they remain stationary. The hunters, as individuals or in teams, do their best to home in on the transmitter with their direction-finding equipment.

The goal is either to be first, or to drive the least miles, depending on the rules of the hunt. While there are occasional all-on-foot events, most hunts in the US involve—RDF-equipped cars, trucks, vans, and even motorcycles. Occasionally, at the end of the hunt, you have to go on foot to sniff out the concealed transmitter.

Nomenclature

As a sport, RDF is usually called "foxhunting" by amateur radio magazines in this country, since that's what it's called on the east coast and in Europe. It's written as one word. In a few places, you may hear of "bunny hunting" instead.

Searches for unlicensed stations, or stations which are causing malicious interference, have been dubbed jammer hunts, turkey hunts, or maverick hunts in the ham press. In southern California, we call all RDF work "T-hunting." The hider is the "hidden T."

Sport RDF is an adventure for the hunters, but it's even more of a challenge for the hider. His goal is to select a combination of location and antenna that will make it difficult for hunters to get reliable bearings. Like a good ventriloquist, he tries to "throw his voice" and make the signal appear to be coming from some other location. Perhaps he will camouflage the setup so well that the hunters won't know that they've found the transmitter unless they literally trip over it.

When you compete in a QSO party or DX contest, you don't know who your competitors were or how well you did until months later. But when you go T-hunting, you know whom you're up against, and usually how well you placed before you go home. After every hunt, you'll find a lively postmortem session with plenty of success and failure stories, either at the hunt location or a nearby restaurant.

Olympic-Style Foxhunting

Just like amateur radio itself, transmitter hunting is a worldwide pastime. In Europe, you have to be an athlete to successfully compete because all the hunting is done on foot. Using hand-held gear, the hunters race off to locate several well-concealed transmitters, each synchronized to go on and off in sequence. The hunters can use maps and compasses in addition to their DF gear, but they can get no other help.

Local, regional, and national DF events in Scandinavia and eastern Europe lead to the IARU Region 1 championship competition, which has all the trappings of the Olympics. There are receptions, banquets, speeches from government officials, and radio and TV coverage. Hunts for prize medals and trophies are held on both 80 and two meters in separate categories for men, women, boys, and teams.

Up to five foxes are scattered on a course several miles long. Hilly, wooded terrain is often selected. Starting times are staggered to force the hunters to work independently, and judges patrol the hunting grounds. Winning times are in the order of 45 minutes.

On the other side of the world, direction finding has become an important athletic competition in the Peoples Republic of China. A national competition brings out the best Chinese hunters and guest competitors from neighboring countries, such as Japan. Rules are similar to European championships, with one interesting variation: Before the hunt, each contestant takes a written exam on basic electronics, transistor circuits, and direction finding. Each point scored in the exam gives the hunter a one-minute credit against his elapsed time in the hunt.

RDFing in America

T-hunters in the US love to have fun, but they're unique because they can and do use their skills for more serious purposes. RDF plays an important part in self-policing amateur radio. Local Interference Committees, part of the ARRL Amateur Auxiliary program, are empowered to solve many ham-to-ham interference problems by peer pressure and jawboning. In an increasing number of areas, there are standing agreements between the Auxiliary and local FCC offices which permit volunteer ham DFers to gather evidence leading to prosecution in serious cases of malicious interference.

Photo A. Every hunter has his own favorite system. At this All Day Hunt start, two teams are using very long yagis. (Photo by Tom Curlee WB6UZZ.)

Photo B. Without accurate map work, a hunter can put on lots of unnecessary miles. Kuby N6JSX ocasionally takes time out to carefully plot his bearings. (Photo by Tom Curlee WB6UZZ.)

Photo C. It isn't enough to have a good vehicle setup in Southern California. You also need to be able to hunt on foot. Here, Clarke WB6ADC makes final adjustments to the hidden transmitter before covering it with brush. (Photo by Tom Curlee WB6UZZ.)

T-hunters can also serve the public by participating in search and rescue activities. DFers working with agencies such as the Civil Air Patrol and the US Coast Guard Auxiliary have helped save the lives of victims of air crashes and boating accidents.

Southern California brazenly lays claim to the title of "T-hunting Capital of the USA." There are close to a dozen competitive hunts scheduled each month in Los Angeles and Orange counties, with plenty of hunters every time. There are also hunts in the Santa Barbara and San Diego areas, and hunts are getting organized in western Riverside county.

Most hunts are on two meters, but there are monthly hunts on 28, 50, and 223 MHz. All hunts are on Saturday or Sunday, daytime or evening. For a list of the regular Los Angeles and Orange County hunts, send me an SASE.

The varied terrain of Southern California adds excitement to T-hunting. Most hunt boundaries include the flatlands of urban Los Angeles and Orange County, plus the Chino and Puente Hills, some of which are over 1000 feet high. The boundaries of the four monthly two meter Saturday night hunts are all different, encompassing areas ranging from 78 to 2320 square miles. The hidden T could be 50 miles away on these hunts.

The most challenging hunt of all is called the All Day Hunt. But that's a misnomer—it should be named the All Weekend Hunt. It's held at least four times a year, starting at 10 AM Saturday from the top of Rancho Palos Verdes. The rule is that the transmitter can be anywhere in the continental USA!

Hiding spots for the All Day Hunt have ranged from the Salton Sea, 228 feet below sea level, to mountain peaks 8000 feet high. It's not unusual for the hidden T to be in a location such as Death Valley, over 200 air miles away. To provide a deceptive two meter signal back to the starting point, All Day Hunt hiders come up with very unusual transmitting setups. This year in May, K6KYW and N6JF used a 35-element yagi antenna with a 100-foot long boom!

Of course, there are transmitter hunts going on all over the US. In the past few years, I've had the chance to talk to hunters in diverse cities, such as Chicago, Phoenix, Daytona Beach, and Boston. All these groups have two meter hunts, but they all do them a bit differently. Some run the hunt like a rally, requiring the winner to have lowest mileage. They say it discourages reckless driving, encourages careful triangulation, and evens out the competition. Sometimes the last team to arrive is the winner in a mileage hunt.

Other groups use time as the winning criterion. They say that time is of essence in a jammer hunt or search-and-rescue operation, so hunters must learn to find transmitters fast. Furthermore, in a time hunt there is no need to worry about the accuracy of competitors' odometer readings.

In some places, hunts for multiple transmitters are common. In others, one well-concealed rig is enough. Some hunts have strict rules about antenna polarization, power variations, and nearness to paved roads. Others say, in effect, "Anything goes!" Most of the time it's "Every team for itself," but in a few towns there are cooperative hunts on repeaters, and bearings from base stations are welcome.

Who can T-Hunt?

Transmitter hunting belongs in the mainstream of amateur radio. Going on a hunt is just as exciting as working a new country. DF setups can be just as high-tech as a packet network or as simple as a Novice station. An informal hunting group can build friendships as well as a formally chartered radio club. Ham RDF can be used for public service and saving lives.

When you've worked that last country you needed to get on the DX Honor Roll, and you think the challenges are behind you, don't wait for the ARRL to invent more countries. Build your own RDF gear (it's not hard; most hunters build some or all of their DF gear), put it in your car, and go on a competitive transmitter hunt. A T-hunter is never able to say he's done it all, because some hider will always be able to find a new way to confound him.

Drop Me a Line!

There are a number of other considerations for developing hunt rules, which will be discussed in future columns. This is where you come in. I want you to share what hunting is like in your area. Are there lots of small hunts, or a few really big ones? Do the local hunters prefer time hunts or mileage hunts? Continuous or intermittent signals? Sniffer hunts or on-the-road hunts? Night or day? Which bands are popular? What kind of hunting equipment predominates? Who is your local "T-hunt guru?" Would you support a national T-hunt championship? Let's make this column a forum for a fascinating aspect of amateur radio! Tell me what's going on in your area, and what you'd like to see in this column. Write to me at PO Box 2508, Fullerton CA 92633 (SASE appreciated if you want a reply), or send a message to 75236.2165 on CompuServe.

Remember, you can T-hunt even if you don't have your license yet. All you need to start is a receiver and a directional antenna system. There may be a hunt in your area this weekend. Find out, and if there is, give it a try! ■

New columnist Joe Moell KØOV has been an avid ham since the age of 11 and a transmitter hunter almost that long. When not T-hunting with his wife, April WA6OPS, he supervises the design of radar transmitters at a Southern California aerospace company. Joe is a Registered Professional Engineer in California. He co-authored, with Tom Curlee WB6UZZ, the book *Transmitter Hunting: Radio Direction Finding Simplified*, a 323-page illustrated T-hunting handbook available from Uncle Wayne's Bookstore.

Hazer

Continued from page 11

Photo C. Winching the the two Hazer side parts above the house bracket.

Photo D. Final bolt tightening before antenna installation and raising.

Actual operation depends on tower guy wire arrangement. All installations should be guyed, wherever possible. There are two methods of tower-end guy wire attachment: (1) tower top (apex) attachment in a conventional manner, or, (2) attached to the top or bottom Hazer main frame by use of the lugs in the kit. When using the Hazer with a conventional tower attachment, temporarily disconnect the two guy wires to allow long beam elements to pass and reconnected for "insurance" as the assembly is completely lowered. When used with Hazer attachment, loosen guy wires only enough to raise the assembly, thereby allowing you to release the safety latch. Remove lower level guy wires, such as those used for 60' towers, to let the Hazer pass. Tag lines (short, lightweight rope), tied to the anchor end of each low level guy wire, can be used to retrieve the guy wires when the Hazer assembly is raised to its operating position.

Conclusion

We have had no troubles with our unit whatsoever. I've spoken with several local Hazer users and they all concur—they've had no troubles with theirs and are delighted with not having to climb their towers to work on antennas! They also concur with this one regret: They hadn't bought the Hazer sooner.

All Hazer kits include all hardware, 1000 pound manually operated winch, 100' of wire rope, top pulley assembly and an instruction sheet. The complete "GME" product line is available in a neat 15-page catalog. Only two pages are used to detail GME products, the remaining pages include specifications, drawings, typical guy wire layouts, photographs, a USA Wind-Pressure-Map, and, of course, an order form with shipping and purchase information. If you contact them directly, please mention where you saw it, and who sent you! ■

Photo E. The Hazer in action at the top of the tower.

Caution:

Safety of all personnel, equipment and real estate is of utmost importance during any antenna work. It is the responsibility of the installer and/or user to exercise all safety precautions at all times. It may be necessary to obtain professional engineering assistance to insure an installation that complies to good engineering practice and with local and national codes.

Kenwood

continued from p. 13

detachable change tray just behind the shift lever. Bear in mind my performance evaluation is based on user observations, not on bench tests.

In every case, the TM-221A's receiver was as sensitive as the older TR-7400A. Selectivity was at least on a par with the '7400. The RF amplifier is a 3SK184 GaAsFET, with a bandpass filter in front and a 3-section Hi-Q bandpass filter following (essentially a helical resonator circuit). The output drives another 3SK184 acting as a mixer. Two stages of crystal filtering are used at the first IF (10.695 MHz), and another monolithic filter is used at 455 kHz.

What makes it all work is the Hi-Q filter and bandpass filter around the first RF stage, since most of the "garbage," such as IMD products, issues from there. Suppressing out-of-band signals to limit compression of the front end goes a long way towards helping you hear that distant repeater! This is a lesson learned the hard way by Kenwood and other manufacturers based in Asia, where RF pollution in heavily-populated areas can be nothing short of astonishing.

The transmitter lineup is fairly conventional. It uses an M57726 hybrid power module with four poles of bandpass and low-pass filtering. Full ALC protection is offered and the low-power output is continuously adjustable from 0–30 watts. High power out claim is 45 watts; I found it at closer to 40. This is largely a function of (1) How long the DC leads to the battery and (2) How heavy a cable is used. The DC leads supplied with the TM-221A are a bit light for nearly 90 watts of DC input, so you may wish to use heavier wire for long runs.

In mobile use, the TM-221A is a piece of cake. The amber backlit LCD display should be mandated for EVERY piece of electronic gear installed in a car. It is equally readable at night or in bright sunlight, unlike the conventional green displays. The display indicates the frequency (or memory channel) in use, selected offset, tone/CTCSS enabled, scan mode, signal strength and power output. Simple enough!

QSY is fast, and even easier when selecting memory channels. One obvious drawback of such a small package is the size of the control buttons! You must be careful not to brush keys when reaching over to make a channel change. An example is the position of the HI/LO power switch adjacent to the POWER ON switch. I invariably punch up low power when turning the radio on.

Conclusion

I highly recommend the TM-221A for both first-time buyers and seasoned 2 meter FM veterans. It is easy to use, offers just the right amount of features and fits nicely inside today's automobiles with limited dash space. Receiver performance is superior in high RF environments (a selling point I cannot stress enough) and the output power is just right for all kinds of mobile work. Besides. . . it looks great under the dashboard! ■

All About Henry

Accurately verify a wide range of inductances with this simple project.

by W.K. McKellips WB4DCV

I had tried building various inductance bridges in the past. Most of the designs worked well on the larger inductances, but are best described as flaky in the lower, microhenry ranges.

Having collected my share of small coils and chokes, I got fed up with buying a new coil for every project when I probably had three of that value in my junkbox. I wanted to measure the values of all those funny looking little lumps of wire, but I didn't want to pay $150 for an instrument to do so.

How about a kit? The July 1988 issue of *Radio Electronics* offered a solution: a build-it-yourself digital inductance meter designed by Neil W. Heckt. There was one drawback, however—the parts kit costs $149!

The Do-It-Yourself Approach

Finally, I read that story and examined the math behind the concept. The idea was delightful. All you needed was a programmable read-only memory (PROM) chip blasted with 16000 answers based on the formula. The rest of the thing was just an oscillator and a cheap frequency meter.

Well! I already had a frequency meter and a $1000 computer sitting around. All I needed was the oscillator. The formula could easily be incorporated into a simple BASIC program.

Circuit Components

The oscillator is ingenious. (See Figure 1.) It's an LM-311 voltage comparator IC connected as an amplifier with positive feedback. It's free-running, but controlled by the inductance/capacitance circuit connected to pin 2. The oscillator will work on almost *any* inductance/capacitance ratio. For that reason, it'll measure from 0.05 µH on up to at least 20 H, the biggest choke I had in my collection.

The only critical component is the 1000 pF silver mica capacitor C1. Capacitor C1 is large enough to more or less swamp out any stray capacity in the circuit. A silver mica generally rates at 5% tolerance, and has very low drift. That should get you an accuracy of about 5%. If you have an accurate capacitance meter, you can get C1's exact value, plug it into the program, and get even better accuracy.

I soldered it together on a Radio Shack Experimenter's IC Perfboard, (Cat# 276-150), that measures 2" x 3". This I installed in a Radio Shack Experimenter's Box, (Cat# 270-233), but I'm sure any small box would do. The binding posts again came from the Shack (Cat# 274-662).

Testing the Tester

After finishing the unit, I used a capacitor bridge to measure C1. The value read, in picofarads, was then plugged into the formula. It doesn't matter at all what value you use for the inductance standard LS because the BASIC program figures the value of LS automatically, and uses it for the calculation.

Very short wire runs between the tuned circuit and the binding posts helped keep stray inductance to a minimum. In my version, I found that shorting the binding posts kept it down to about 0.05 µH.

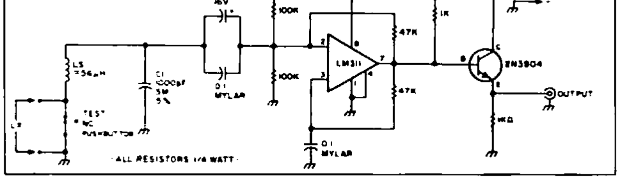


Figure 1. The oscillator circuit. Note the LC circuit attached to pin 2 of the IC. This circuit oscillates with a wide range of inductance/capacitance ratios.

Figure 2. PCB foil for the oscillator.

Now You've Got It Made

Type in the BASIC program I've listed, and save it. Connect the unknown inductance to the binding posts. Turn on the power switch and let the circuit oscillate for a second or so to stabilize, then read your frequency meter for the first frequency: F1. It will be about 600–700 kHz. Write it down. Now push the TEST button and read F2 on your frequency meter. Write that down as F2.

Now run your computer program and enter the values of F1 and F2. Voila! There's the value of the coil on your computer screen.

You could probably modify the meter to figure unknown capacitance, but in my case, I already had a capacitance meter, and wanted to keep it simple.

So, go ahead and build something, have fun, and save a pile of money. I sure did! 73

Program Listing

```
10 REM ALL ABOUT HENRYS
20 REM 1ST FORMULA FROM AMATEUR HANDBOOK
30 C1 = 1000: REM C1 = 1000 UUF.
40 HOME : VTAB 8: PRINT "FREQUENCIES SHOULD BE
   IN KHZ.": PRINT
50 INPUT "ENTER FREQ #1 (XXX.X): ";F1
60 IF F1 = 0 THEN END
70 F1 = F1 / 1000: REM CONVERT TO MHZ FOR FORMULA
80 LS = 25330 / (C1 * (F1 ^ 2))
90 LS = INT (LS * 100) / 100
100 PRINT : PRINT "INDUCTANCE STANDARD: ";LS"
    UHYS": PRINT : PRINT

110 REM 2ND PART FROM JULY '88 RADIO ELECTRONICS
120 LS = LS / 1000000:F1 = F1 * 1000
130 INPUT "ENTER FREQ #2 ";F2: PRINT
140 IF F2 > F1 OR F2 = 0 THEN HOME : END
150 LX = ((F1 / F2) ^ 2 - 1) * LS
160 PRINT INT (LX * 100000000) / 100;"UHY."
170 IF LX < .001 THEN 210
180 PRINT INT (LX * 100000) / 100;"MHY."
190 IF LX < .01 THEN 210
200 PRINT INT (LX * 1000) / 1000"HYS."
210 PRINT : GET ANS$: PRINT : GOTO 130
```

Table 1. Program listing to use with the oscillator to calculate unknown inductances in coils.

Program Listing Notes

The program is written in Microsoft BASIC. See the program listing.

Line 30: Change the value of C1 if you have a more accurate reading for it.

Line 50: Input your frequency reading in kiloHertz, such as "645.5". You generally won't need to enter more than the first four figures.

Line 60: If you want to quit, enter "0" and the program will end.

Line 70: Converts kHz to MHz for the formula to work.

Line 80: This is formula #1 for figuring the standard inductance value, LS.

Line 90: This rounds off all the extra figures for a clean printout.

Line 120: Here we convert LS and F1 to work in formula #2.

Line 140: If you want to quit, or if F2 is larger than F1, the program ends. F2 will always be lower than F1 because you are adding inductance to the circuit in series with LS.

Line 150: Here's the second Biggie. This formula figures the value of the unknown inductor, using F1, F2, and LS.

Line 160 through line 210 print the value and offer you a chance for additional readings.

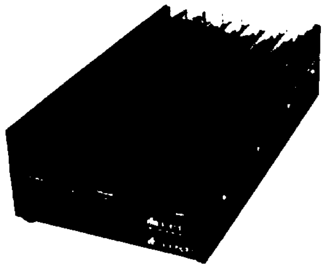
The program was written for an Apple II+ but it is so simple that you can probably easily translate it into other BASIC languages.

Number 13 on your Feedback card

73 Review

by Pete Putman KT2B

RF Concepts Model 3-312 220 MHz Power Amplifier



RF Concepts
2000 Humboldt Street
Reno, Nevada 89509
Price Class: $264

A great way to boost your signal.

A common saying in ham radio goes something like, "You can never have enough power." Perhaps I can amend that somewhat to read, "It's always nice to have more power". . . especially on 220 MHz, where there are a variety of operating modes, from weak-signal work to repeaters and packet.

RF Concepts has answered that need quite nicely with the RFC 3-312, a medium-power "brick" with a built-in preamplifier. Following in the footsteps of their very popular amplifiers for two meters, Everett Gracey WA6CBA and Ken Holladay K6HCP have brought forth a nice complement to the wide range of 220 MHz transceivers available today.

The RFC 3-312 is designed to accept drive power over a range from 200 mW up to 40 watts, which pretty well covers all the bases. Both hard keying and RF-sensed, VOX-type keying are available, and a preamp is included to help pull out the weak ones. The attractive, black aluminum housing has more than enough heatsink capacity.

The device line-up consists of a pair of Motorola SRF3883 devices with a hybrid combiner operating in Class AB mode. Therefore, the 3-312 is capable of linear operation with any mode of modulation, be it FM, AM, SSB, or just CW. The preamplifier is a Telefunken CF-300 GaAs device driving a U309 buffer amplifier, with the combination yielding 18 dB of gain at about 1.2 dB noise figure.

Front panel controls select power, SSB/FM mode, and preamp. Incidentally, I've found that a bit of confusion exists regarding the SSB/FM switch on most solid-state amplifiers. It does not change the mode of operation, only the keying drop-out delay! When in FM, the amplifier still operates in Class AB, not Class C, as some operators apparently think.

Rear panel connectors for RADIO and ANTENNA are conventional UHF types. A four-pin TRW/Jones connector is used for power, while a standard RCA connector enables the hard-keying circuit. The RFC 3-312 is factory wired for positive keying as opposed to negative keying, as the manual claims that "most transmitters have a positive voltage available at their back panel." The good news is that you can remove the cover and change one plug-in jumper when you want to go back to negative keying. This review amplifier was tested with an ICOM IC-375A (that does have negative keying), as well as with a plain old footswitch.

One additional connector is a 5-pin DIN-type that enables remote control of the amplifier's functions. It's similar to the Mirage remote control function. Although RFC does not now make a remote control head, they have a schematic of the jack wiring, and they supply a companion 5-pin DIN plug so you can roll your own. Finally, the dropout delay in SSB mode is adjustable via a hole in the side.

Measurements

See below for the test results. For the preamplifier test, I used an HP-608F signal generator and Boonton 92 RF millivoltmeter; for the amplifier test, an IC-375A as the signal source, two 6 dB pads, two Bird Model 43 at the input and output, and an Astron RS-35M power supply. Note that all measurements were made at 14.3 volts, as opposed to the specified 13.8 volts, so power output may be a bit higher than the average.

Performance Tests

RFC 3-312 220 MHz Power Amplifier

Amplifier

Input Power	Output Power
2 watts	22 watts
4 watts	50 watts
6 watts	75 watts
10 watts	95 watts
15 watts	105 watts
17 watts	110 watts
20 watts	120 watts
25 watts	125 watts

Test voltage: 14.3 VDC.
Maximum current @ 125 watts: 18.5 amps.

Preamplifier

Input Level	Output Level
−40 dBm	−24 dBm
−30 dBm	−19 dBm
−25 dBm	−9 dBm
−23 dBm	−7 dBm
−22 dBm	−6 dBm
−21 dBm	−5 dBm
−20 dBm	−4.5 dBm
−19 dBm	−3.5 dBm
−18 dBm	−3 dBm

Preamplifier has 18 dB of gain.
1 dB compression occurs at −3 dBm output.

The RFC 3-312 certainly has an abundance of power. It easily met the factory specification of 120 watts output for 30 watts drive, and, although I used a slightly higher voltage, I would expect 25 watts of drive to saturate the amplifier at full output.

The preamplifier has enough gain to engage in serious weak-signal work, but may "crunch up" in a high RF environment. The 1 dB compression point of −3 dBm is slightly less than average performance for a GaAsFET design. High-performance units will typically have a 1 dB compression point of better than +3 dBm, and I consider 0 dBm to be about average. 220 MHz operators close to a TV Channel 13 transmitter may experience some degree of IMD products with this design.

Field Performance

The RFC 3-312 got a fairly rigorous workout during the 1988 June VHF QSO Party, as it was at one time or another (1) an intermediate driver stage for an 8877 power amplifier, and (2) a final stage for the 220 FM station. It took us a bit of tweaking, but we were able to coax 1200 watts from the 8877 with the 3-312 driven by the previously mentioned IC-375A. Our 220 SSB/CW station was constantly on the air as we worked over 80 stations in 28 grids with excellent reports.

Conclusion

The RF Concepts 3-312 220 MHz amplifier is a well-designed piece of equipment that will surely get a lot of use from 220 operators. Workmanship is of the highest quality and the amplifier easily meets the published specifications.

A Lap-Top Repeater Controller

Full-featured repeater control from a PC-DOS lap-top computer.

Jim Edrington KF5WO

Several controllers have been built around home computers, such as the Commodore, Atari, and Radio Shack. These low cost computers perform basic repeater functions well. However, they lack many desirable features for a repeater controller or regular computer. Adding options to make these low cost computers more useful quickly raises their cost. The cost of adding a disk drive, for example, may be several times the price of the computer.

Until recently, full-featured microcomputers were large and power hungry, taking whole desk tops and requiring noisy fans for cooling. Now available at a reasonable price are a new breed of computers. They are the first to combine the power, features, and standardization (IBM compatibility) with the small size, battery powered capability, and other features desired for a repeater controller. These are the laptops, such as the IBM PC Convertible and the Toshiba 1000 series.

This article describes the hardware and software design of a repeater with the IBM PC Convertible as the controller. This design has been operating for over a year without attention, except for a few days following a lightning storm, that damaged the modem.

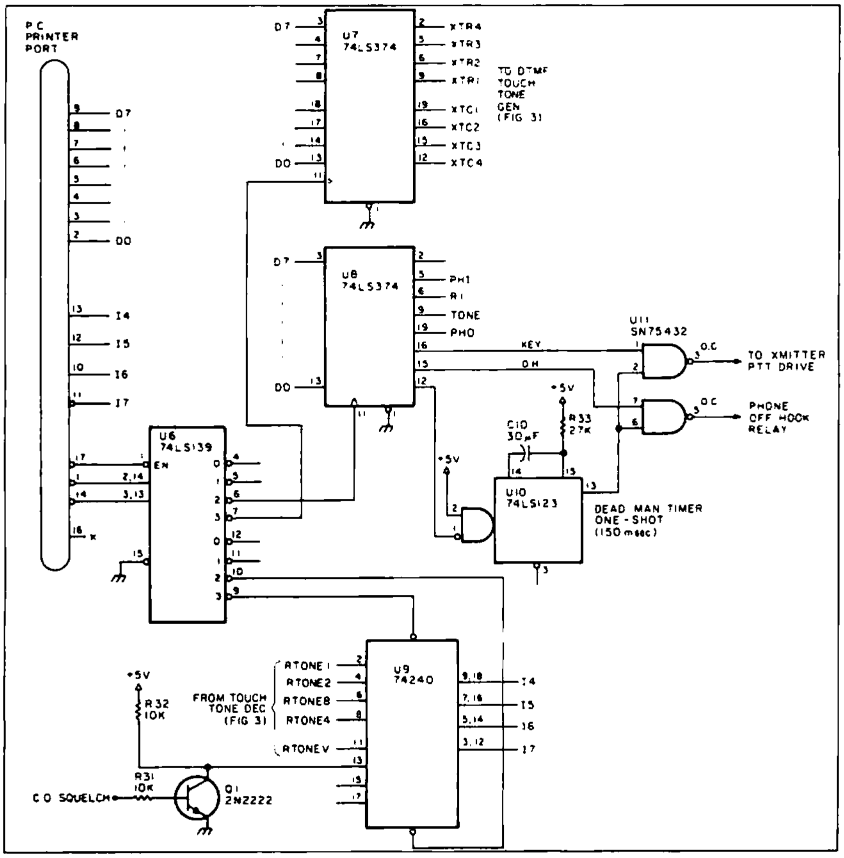


Figure 1. Schematic for the interface between computer and repeater.

Hardware Design

The design goal was to take as much advantage of the computer as possible, reducing custom hardware to an absolute minimum. It is always easier to duplicate software (DISKCOPY A: B:) than to duplicate hardware (buy, bend, solder, test, etc.). A computer, specifically modern laptop models, offer many of the hardware functions needed to build a top notch repeater controller.

- Battery backup built-in, for power transient immunity.
- Low power consumption, which is great for remote sites and long life.
- Built-in clock and calendar features.
- Internal modems for remote control and programming via the telephone.
- Small size, to fit in equipment racks.
- Built-in mass storage, for anything from program load to logging the history of repeater usage.
- Full programmability.
- A sufficient amount of regulated power for external circuits.

Many computers, including the Convertible, offer a speech synthesizer as an option. Speech adds highly desired features to modern repeaters. It allows non-code types to understand the ID, for example, and it reports phone patch operation.

Until the day when someone markets a "repeater controller adapter" for a personal computer (my apologies if there is one of which I'm not aware), some custom hardware will be required. For a repeater equipped with a phone patch, the following functions external to the computer are needed:

- Input to the computer from the radio receiver squelch.

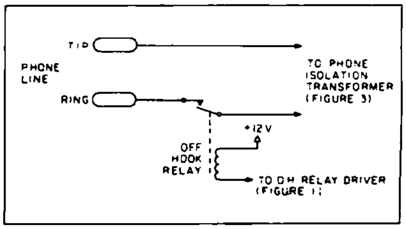


Figure 2. Telephone interface for the repeater controller.

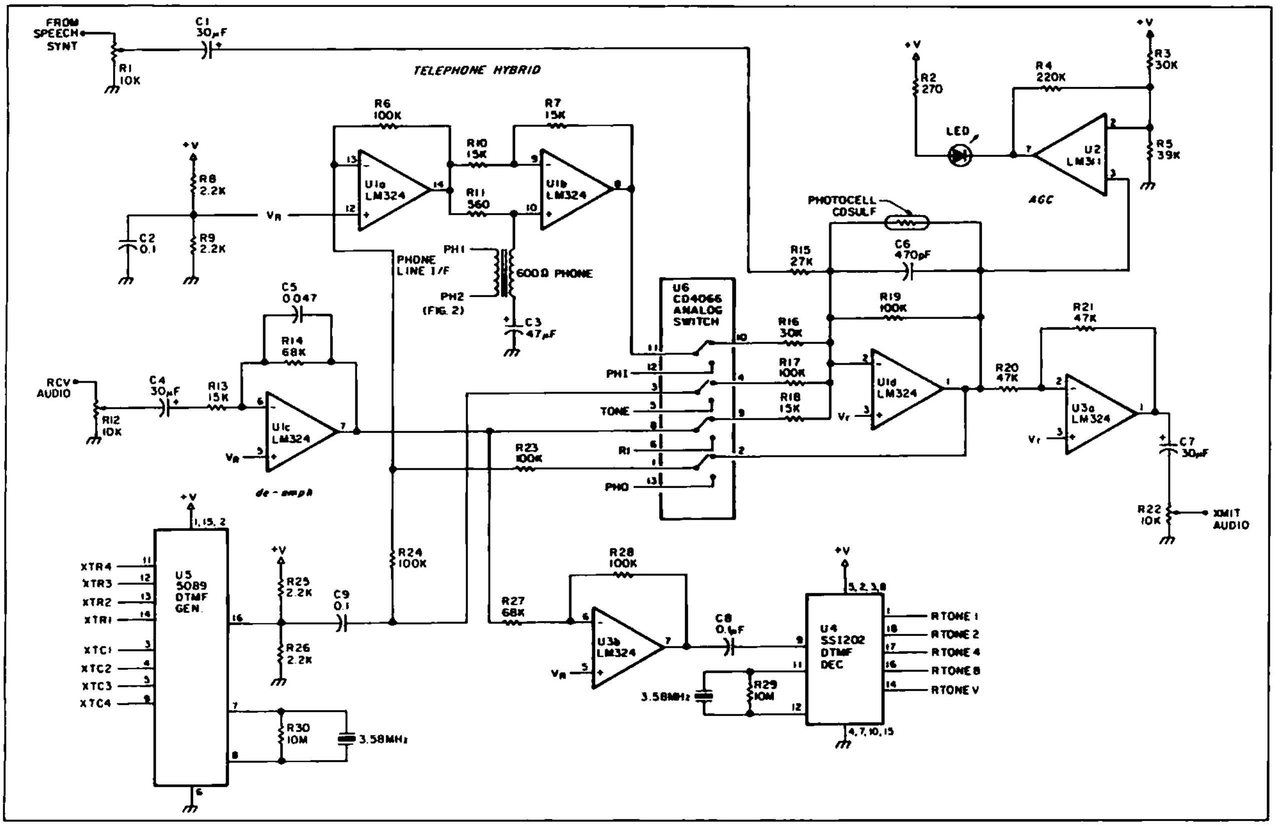


Figure 3. The audio circuits for the repeater controller.

- Output from the computer to key the transmitter.
- A dead-man timer function, to disable the transmitter if the computer or software should fail.
- A tone generator, for repeater ID.
- Audio circuits for de-emphasis/pre-emphasis, level control, and audio routing.
- Some means of remote control, so that a control operator can disable the repeater in case of trouble.
- The telephone interface, with its associated off-hook circuitry, DTMF generator, DTMF decoder with protection, and isolation.

The Computer Interface

Somehow the computer and the repeater hardware must talk to each other. In computer talk, this is known as the interface. An interface can take many forms, and can vary widely from computer to computer.

To simplify connection to the computer, and to make the connection standard, we routed all computer input and output (except for speech and power) through the printer port. Virtually all personal computers use a Centronics-type parallel printer port. Although this port is normally for output only (eight lines with a strobe), nine of its status lines will work for input as well as output. These lines are normally used for such functions as monitoring the printer's paper supply and on-line status.

Since the above functions require more than 17 lines, multiplexing (using a line for more than one purpose) was necessary. Two of the output control lines were decoded into four select signals using a 74LS139 type decoder chip. These select signals control 74LS374 octal latches, enabling the computer to provide up to 32 individual outputs (four times the normal eight). The computer can read up to 16 input lines by using the four select lines to multiplex data onto four of the input status lines. Only 16 output lines and eight inputs lines are implemented here. For maximum reliability, a separate control line is dedicated to the dead-man timer. This circuitry is shown in Figure 1, the interface schematic diagram. The logic used to implement these circuits is the 74LS series. You could use equivalent functions in CMOS for lower power consumption.

The Telephone Interface

A typical telephone interface is shown in Figure 2 and part of Figure 3. You need FCC approval before connecting anything directly to the public phone network. All circuitry on the telephone side of the transformer should be well isolated from other circuitry and the chassis. Keep in mind that the DC voltage on an open phone line is about 48 volts, and that when the phone rings, 150 volts peak-to-peak appears on the line. Keep fingers off!

In Figure 3, when the two op amps (U1A and U1B) are connected to the telephone transformer, they perform the "hybrid" function which prevents the outgoing audio from appearing as incoming audio. Equivalent circuitry in a telephone receiver allows you to hear Aunt Emma in Osh Kosh, but not your own voice too loudly. U1A drives the telephone line through the transformer. U1B is connected so that the voltage at the output of U1A appears at the inverting and non-inverting inputs (of U1B) equally, thus canceling each other. The voltage at the phone transformer, appearing only at the non-inverting input of U1B, is amplified.

In Figure 1, a relay closes a path for direct current through the primary side of the phone transformer. This tells the phone company that you are "off hook." This relay is also controlled by the computer via the printer port.

Audio Circuitry

The controller must handle four audio sources. They are receiver audio, speech synthesizer audio, dialing tones, and telephone audio. Audio must be routed, at the proper time and level, to the transmitter and/or the telephone.

The audio circuitry of the controller is shown in Figure 3. This circuitry is built around a summing op amp (U1D) with four possible inputs, some switched. The switch is a CD4066 IC analog device (U6) which the computer controls. This way, the proper audio signal is sent to the transmitter and/or the telephone, depending on the operating mode. Note that all outgoing audio is passed through an AGC (automatic gain control) circuit to prevent overdrive. The gain control element is a Cadmium-Sulfide photo detector used as a variable resistor in the feedback path of op

amp U1D. Whenever the output of U4 reaches voltages that exceed the voltage formed by the R3, R4, and R5 network, the LM311 comparator (U2) switches on the LED. This illuminates the Cadmium-Sulfide photocell and causes its resistance to drop, reducing the gain of U1D. Because the reaction time of the photocell is very slow compared to audio frequencies, the result is a gradual change in gain. U1D, as well as all the other op amps, is ¼th of an LM324 quad op amp. We picked this op amp because it operates well on low voltage, permitting all circuits to operate on +5 volts.

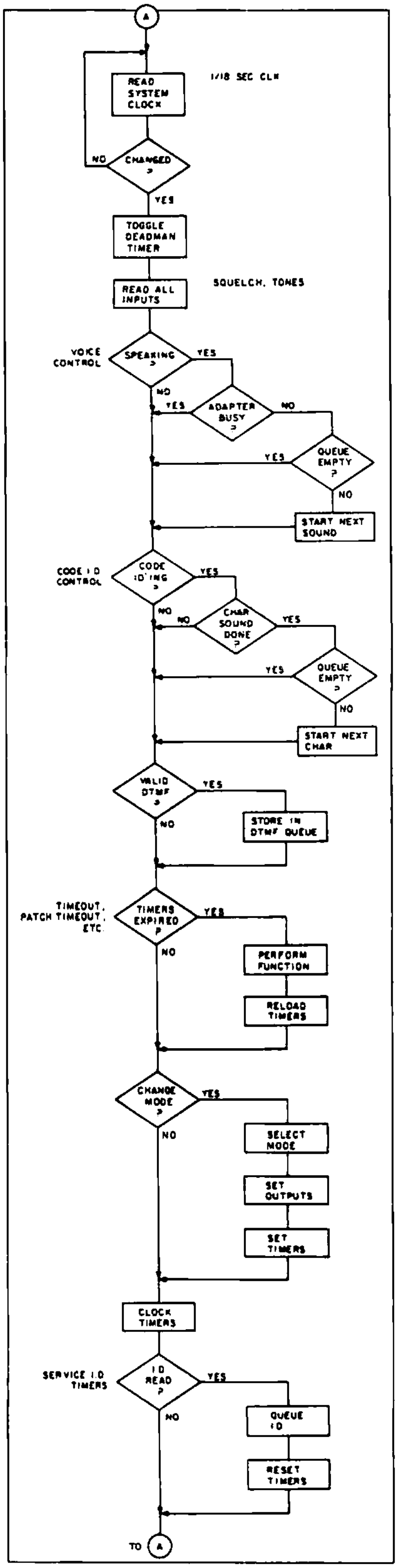


Figure 4. Flowchart of the repeater controller program.

Receive audio is passed also to an SSI-202 IC (U4) which detects DTMF tone pairs. The logic signals indicating these tone pairs are passed to the computer interface for autopatch and control operator functions.

The computer interface controls a 5089 type DTMF generator (U5) that produces dialing tones for phone calls and Morse code identification of the repeater.

Table 1 shows the modes of operation, and the state of all switches and relays in each mode.

The Speech Synthesizer

We chose the IBM PC Convertible partly because of the optional Speech Adapter. This does not preclude the use of other computers, as speech devices are available for standard PCs, and could be adapted to most laptops.

The Convertible speech adapter is almost identical in function to the one for the PC Jr (also from IBM). It contains two speech systems, one for canned speech (using the ever present Texas Instruments speech chip) and the other for recording and playing back speech. For this application, only the canned speech was used, since the computer cannot do anything else while the record/playback mode is in operation. This means a compromise in the real-time control of the repeater.

The Computer

The Convertible has 256K of RAM, two floppy disk drives (although only one is needed), an LCD, and an internal 1200 bps modem. Snapped on the back (which is how options are attached) are two adapters: a speech adapter and a serial/parallel (printer) adapter. An external power unit supplies 12–15 volts to the computer, which has an internal battery. This battery normally powers the computer for six or more hours, which is adequate for most power outages. In reality, it will probably lose its capacity after a few months of full charge, since NiCds need to be discharged regularly.

A good solution to this problem is to float a small lead-acid battery in parallel with the external power source (with diodes to prevent reverse current flow). Lead-acid batteries will operate for years if not overcharged. Motorcycle or lawn tractor batteries are ideal.

If the computer loses power, it will do no harm. When power is restored, the software and all programmed phone numbers, and other data, are reloaded from the floppy disk. Time functions, such as the computer's internal clock/calendar, have to be reset after a power down.

Writing the Software

To get this repeater going, I spent much time writing and debugging software. Software is best understood when viewed from two angles. The first is a distant observation of the high level functions, and the second is a close observation of the details of each function. This is like studying the design of a radio transceiver—first you look at the block diagram to see the overall signal flow, then you look at the schematic to determine the function of each component.

One of the advantages of the full-featured computer, such as an IBM PC or compatible, is the wealth of powerful development tools. Text editors, such as PC-Write, are available at minimal or no cost, and are essential to ease code writing and documentation. Professional level assemblers and compilers are also now available from Borland and MicroSoft, among others, for $50 and up.

The program for this controller was written in Lattice "C." The "C" language has recently become the standard for program development almost everywhere. Certain portions of the program, such as those interfacing with the repeater hardware, were written in 8088/86 assembly language, which is easy to use with most "C" compilers. Borland's Turbo Pascal would be a good alternative, with its built-in capacity to produce inline assembly language.

Programming The Program

When we talk about programming, we must distinguish between the program running in the computer's microprocessor, and the program the user accesses to set the ID (call sign), speed-dial phone numbers, repeater timeout limits, and so forth. I call the latter "user programming."

Continued on page 33

Mode	RCVR	DTMF	PHONE IN	PHONE OUT	XMTR KEY	OFF HOOK	SPEECH
Idle							
Repeat	X				X		
Calling Announce	X				X		X
Patch Dialing					X	X	
Patch Transmitting			X		X	X	
Patch Receiving	X			X	X	X	
Voice IDing	X				X		X
Code IDing	X	X			X		

Table 1. Controller Operating Mode.

A full-function computer has diskette drives, which gives us lots of memory for all kinds of functions. Whenever the repeater program starts, it accesses the diskette, and read these parameters into the computer's memory for instant access. Since these parameters are stored in a file on diskette, they are easily saved and duplicated.

An even bigger advantage to storing the user programmed parameters in this manner is that they can be stored in human readable form. Here are some examples of how the parameters appear in the file for this repeater controller:

TR = 3
TP = 10
123 = 5552345
911 = 5550987
TI = KF5WO/R

This data tells us (and the repeater controller program) that the time limit for the repeater (TR) is three minutes, that the time limit for the phone patch (TP) is 10 minutes, that the speed-dial code 123 calls the number 555-2345, and that the emergency speed-dial code 911 calls 555-0987. The last line defines the tone identification (TI) used by the repeater.

You can create and change this parameter file by using any computer (including the repeater controller) and a text editor. Keep records of the file just by printing it out. This is best for major changes, or when initially setting up the controller. Alternatively, you may change the parameters from a remote location, while the repeater is operating, via one modem in the repeater computer and another modem at the distant location (at home, for example).

A control operator at home, using a terminal program on any computer, can dial up the phone at the repeater site. The repeater control computer's modem answers the phone, establishes communications, and permits the operator to set any desired parameter or phone number, or just check existing parameters. For example, the control operator can see all parameters by typing "?". He can get instructions on how to change parameters by typing "HELP". To prevent hackers from disrupting the repeater, a password is required at startup.

The Controller Program

Repeater controlling software must operate in what is called "real-time." This means that external events, which may happen at any time, must be watched and action must be taken immediately following these external events. In addition, the software must perform functions, such as generating Morse code IDs, which require precise timing. A block level flowchart of the program is shown in Figure 4.

The software used here is clock driven. This means that all inputs are read and all outputs are performed on the tick of a clock. This way, we are assured that all inputs are regularly monitored and that actions can be timed accurately. Of course, we need a clock that ticks more than once per second, or we could miss external events (such as a DTMF tone). The IBM PC (and all compatibles) has a clock that ticks approximately 18 times per second, and which can be read by a program by doing a BIOS function. BIOS stands for "basic input output system." It is software built into the computer to provide a standard software interface to devices, such as the printer, screen, and keyboard. For example, it allows software to send text to the screen, regardless of the type of display adapter and installation.

Timing events of any length is accomplished by using a program variable, which is incremented or decremented at each tick of the 1/18-second clock. For example, counting to 180 would take the program 10 seconds, if one count is done at each clock tick.

Most of the time, the program is just sitting and watching this clock. When the clock ticks (indicated by a change of time read via BIOS), the software goes into action.

The Clock Strikes 1/18... Dead-man Timer

The first thing that the software does is toggle (change the state of) one of the printer port output lines to re-trigger the 74LS123 one shot, or dead-man timer. If this one shot was not triggered regularly, it would time-out, shutting down the transmitters and hanging up the phone. This protects us from any computer or software failure which might otherwise leave the repeater on the air, but out of control.

Inputs

Next, the input lines are sampled. These lines are tied to the receiver squelch and the DTMF tone decoder. If any of these lines change state from the last sample (their old state is stored), software "flags" are set. Software flags are simply variables which are either a 0 (meaning off) or a 1 (meaning on). These flags will be examined later in this timing step, when decisions must be made. They are always cleared at the end of each timing step, and before the input lines are sampled at the next 1/18 second tick.

Throat Clear?

At each timing step, another software flag, the "speech-in-progress" flag, is tested to determine if any speech is underway. This is necessary because many phrases we want to say are made up of more than one word or sound from the speech synthesizer. We must therefore queue up the words while the software goes about other things. If speech is indeed under way, the speech adapter is checked to see if it is still busy with the last word we told it to say. If it is busy, we must wait.

If, however, the speech adapter is idle, the software goes to the speech queue, gets the next word, and commands the speech adapter to begin speaking that word. If the speech queue is empty, the "speech-in-progress" flag is cleared.

Making It Talk

As described earlier, the PC Convertible Speech Adapter is used in the canned speech mode. This mode works in the "background," thus allowing the computer to resume normal repeater control once speaking begins. It is limited to 200 sounds in this mode, not all of which are useful in repeater operation. Making it say these words is easy, however. You must write a program to send the Speech Adapter "BIOS calls." This is similar to the BIOS call to read the computer's clock, described previously. The Speech Adapter contains its own BIOS, which allows the following three computer assembly instructions to make it say "DANGER:".

```
MOVBX,09
MOVAX,0201H
INT4DH
```

Here 09 is the number representing the word "danger," 0201H is the hex number meaning "say it now," and the first two instructions place these numbers into the microprocessor's registers. The third instruction is a software interrupt, causing the execution of a program contained in ROM in the speech adapter.

Code ID?

Morse code IDs are generated by software turning the DTMF generator on and off, timed to create dots and dashes. The DTMF generator is programmed to generate single tones, instead of the dual tones normally used for phone dialing. A "code-in-progress" flag is set whenever a Morse code ID is in progress. Morse code characters are queued up in a manner similar to the speech words, and are pulled out by software as the previous character is completed. A lookup table in the program data area is used to convert the characters to the proper series of dits and dahs.

Phone Number?

At each timing step, the DTMF decoder input flags are examined to determine if a valid tone pair has been detected. If so, this tone is queued up, and the "valid tone" flag is set. For privacy, it is desirable to prevent these tones from passing to the transmitter, but in this design, the first tone is allowed to pass. This is because, at times, many voices might sound briefly like DTMF tones. If a second valid tone is not detected within a two-second period after the first, the software assumes that the detected tone was an error, and allows voice to continue (and empties the queue).

If a second valid tone is detected, the audio path to the transmitter is shut off, preventing the tones from being re-broadcast. If no more tones are detected for five seconds, audio is restored and the queue is emptied.

Valid tones are accumulated in the queue as long as the repeater controller detects a valid carrier. When the operator entering the tones releases his key, the tones (representing numbers and other symbols from the tone pad) are examined for meaning. If the number sequence received matches an operator

Continued on page 92

CES *continued from p. 14*
to the phone line. A six-foot cable with a modular plug comes with the unit.

There are two circuits in this unit not found in many autopatches. One is a VOX circuit that detects when the person on the phone is talking. This varies the sample rate in simplex operation. A noise-operated squelch simplifies connection to the radio receiver. No COR input is needed, just raw non-deemphasized audio straight from the discriminator. A provided CTCSS input can be used as a COR input though, if you'd rather connect it that way.

An audio AGC circuit equalizes the audio level between the phone line and the transmitter.

To minimize possible noise problems, digital and audio circuits are separated on the PC board. One side is digital, the other, audio, with separate voltage regulators for each side.

The Manual

The present manual is basically well written, but falls short in a few areas. Some function descriptions aren't detailed enough. For example, the manual doesn't explain about the CTCSS control input being used as a COR input. Neither does the manual explain why there are three different letter A's in the CW programming chart. There are other redundant letters in the chart. When I called CES (they have a toll free number!) I was told that those letters are for foreign language use. One letter A was supposed to have two dots above it. Another A should have been printed with a bar above it, and so on with the other extraneous letters. Also, repeater controller operation is barely mentioned. The folks at CES assured me that a new manual is being prepared, and should be out by the time this review appears in print.

Setup

You can program the Smartpatch and set its levels only after the patch is fully connected to the transmitter, receiver, and phone line with which the unit is to be used.

Programming both the jumpers and the on-board EEPROM memory was not difficult. Most, but not all, of the jumpers are the pin and jumper block type. JP1 was a little tricky to find—it turned out to be a wire soldered between two holes in the board.

The programming section of the manual appears a bit intimidating at first, but once you get started it's not bad at all. There are plenty of examples to help you with the codes. Plus, all parameters have preprogrammed default values in case you miss something.

It's best to go through the manual and write down all of the programming codes you'll use first so that they can be entered easily once you start. There are timers that limit the time an entry may take, so it's good to have them worked out on paper beforehand.

EEPROM programming can be done locally with the supplied DTMF decoder or remotely via phone line. I enjoyed this part! The patch beeps every couple of keystrokes to let you know you're proceeding properly. If you make an erroneous entry, it sends you an understandable CW error message.

Setting audio levels properly is a little harder. The writer of the instruction manual assumes that you have on hand an FM service monitor or the combination of a deviation monitor, an audio generator, and an oscilloscope. Although I have the equipment, I tried setting it up by ear. I had everything sounding pretty good, I thought, until I actually tried to make a phone patch call and I couldn't make it work. The phone line wouldn't accept the digits I was dialing. I had to use an oscilloscope to set the level from the receiver into the patch, and the audio level into the phone line.


Photo C. View of the piggy-back MOSTEK microprocessor with the touchtone decoder. "Tone Decoded" LED is in the foreground.

It took me less than an hour to get operational the first time, and that includes wiring everything together!

Operation

I tested the patch in two different settings. First I tried it in simplex mode with my ICOM IC-245 synthesized two meter transceiver. Then I tried it as a repeater controller and autopatch with a 220 MHz Motorola MICOR based repeater.

In both modes of operation, the patch offers the standard timeout and activity timers, toll restrict, toll restrict override controls, and reverse patch operation.

The connect and disconnect codes can either be the standard * up and # down, or programmable three-digit codes.

Toll restrict can be programmed to work on either the first or second digit dialed. Both digits are programmable. Toll restrict can be totally enabled or disabled, or you can enter a special override code which allows you to make one toll call. After disconnect, it automatically rearms.

Simplex Operation

In simplex mode, the patch worked well with my synthesized ICOM. The default sample window time of 60 ms was more than adequate. I was even able to reduce it to 25 ms with the rig in low power mode.

The constant "kerchunks" I had to listen through when using the patch with a synthesized rig bothered me, but this patch senses when the person on the phone is talking (the VOX circuit) and slows down the sample rate so that the kerchunks are not as frequent when you're trying to listen. The patch samples in between syllables rather than words, and the sample rate changes and slows down between pauses. Dial tone and other telephone signals won't fool it, thanks to the call progress tone filter in the DTMF decoder.

If a crystal-controlled rig had been used with a shortened squelch time constant, the "kerchunk" would have been reduced to a less bothersome "click."

Repeater Operation

With the patch connected to my repeater, I learned its repeater controller functions. There is a transmitter timeout timer and an ID interval timer that must be set, in addition to the autopatch timers. If the Auto ID mode is activated, the repeater call must be programmed into memory as well. A single, non-programmable, courtesy beep can be enabled or disabled. It has an associated programmable "PTT Delay" timer for keeping the transmitter up after the beep.

There is also an autopatch enable control that allows the control operator to enable or disable the autopatch function without affecting its operation as a repeater controller.

The unit has two functions for turning on and off external devices, but strangely, they are not brought to the outside world. CES plans to include an addendum in future manuals that will show you how to access these functions.

Since I had the repeater connected to my home phone line while I tested the patch, I especially appreciated one feature of the patch—it won't allow an interconnect if the phone line is already busy. This is great when your repeater is located in your home and your wife is using the phone. She won't get a rude earful of touchtones from someone attempting to make an autopatch call, nor will her

conversation suddenly end up on the air. This is a definite marriage saver! If you're not married or don't care, you can use the jumper provided to defeat this feature.

Reverse Patch

There are two modes of reverse patch operation. The first is "Auto Answer" mode. In this mode, the patch will answer the phone after a preprogrammed number of rings and wait a preprogrammed time for further control codes.

The caller can then enter a remote programming code, or a multi-digit security code. If the correct security code is entered, the patch will immediately connect to the phone line. If neither the programming code nor the immediate connect security code is entered, or if the channel is not busy, the transmitter then regenerates part of the security code. A designated mobile can then complete the connection by dialing in the same code that was transmitted to him.

In the "Non-auto Answer" mode, the patch senses the phone ringing and generates a long beep out over the air. Anyone can then answer the phone by just dialing the regular connect code.

In either reverse patch mode, the patch monitors the receiver and will not allow itself to bring up the transmitter when it senses a signal already on frequency. If a signal *is* on frequency, the person calling on the phone line hears an error message and the call is then terminated. Software allows you to defeat this feature.

Opinion

This patch performs excellently. Its audio quality is excellent. Programming is flexible and is easily done remotely. I suggest below, however, a few improvements.

First, the instruction manual needs some elaboration in certain areas. Second, CES should consider putting a decent connector on the rear of the unit, and labelling the connector terminals. The terminal block on this patch is on the circuit board inside the unit, requiring cover removal for wire connects/disconnects. You also have to refer to a diagram in the manual and then count positions to find the right terminal.

Third, CES should move to the front panel an LED on the PC board that indicates when a DTMF tone is decoded. In a DTMF-dependent device such as this, a "tone decoded" indicator is as important to monitor as a NOISE or PTT indicator.

Fourth, there should be automatic stop-bit insertion. When I programmed in my call letters, I forgot to also program in a stop bit as mentioned in the manual. This caused several extraneous characters to be sent after my call. Though easily corrected, there's no reason why internal software can't automatically insert the stop bit when one exits the programming mode, to completely avoid this snag.

Fifth, though the unit contains the circuitry capable of doing this, it doesn't regenerate touchtones into the phone line. The patch stores the phone number and redials it as pulses, but not as touchtones. A slight software change here can eliminate one of the bigger headaches in autopatchdom?

In Sum

The above comments fall in the category of nitpicks. The CES 510SA-II telephone interconnect is an excellent autopatch and repeater controller, from a company with an excellent reputation. Before doing this review, I had heard nothing but good reports from friends who own this model. Now that I've had the chance to test one myself, I can say that if you're looking for a good mid-featured autopatch/repeater controller, the Smartpatch II from CES is an excellent choice. ■

CES 510SA–II Specifications

Modes of Operation:	Simplex, half, or full duplex
Connect/Disconnect Codes:	* & # or three digit codes
Simplex Sample Window:	Variable 2ms–512ms
Simplex Sample Rate:	100ms–3.000ms
Call Limit Timer:	up to 42 minutes
Activity Timer:	up to 4 minutes
Rptr Timeout Timer:	up to 16.6 minutes
Rptr Hang Time:	up to 9.99sec
Timeout Warnings:	10 seconds of warning beeps
Toll Restrict:	1st or 2nd digit programmable
Automatic Ring Out:	General or Directed
Toll Restrict Defeat:	Three digit code
Automatic CW ID:	Five programmable
Dialing:	DTMF or pulse. Europulse DTMF not regenerated
Phone Busy Lockout:	User selectable option
Busy Chan. Xmit Lockout:	User selectable option
User Control output:	MOSFET drain pulling to ground
Remote Disable:	Rear connection
CTCSS Enable - Disable:	Rear connection
Audio Requirements:	
Input:	50–2000mV RMS
Output:	0–1 V RMS
Interface Signals Req'd:	Ground, +12V, PTT, Tx audio rcvr discriminator audio Telephone tip & ring
Programming:	Locally via supplied DTMF keypad, or remotely via phone line
Dimensions:	8.25 x 1.5 x 9.5"
Weight:	3lbs., 13oz.
Power Requirements:	10–15 VDC at 300mA

Table 1.

Full-duplex, Half-duplex, Simplex?

These terms refer to the way the repeater or autopatch handles audio information. **Full-duplex** means that audio passes into and out of the phone patch at the same time. A normal land-line telephone operates full-duplex because one can talk and listen simultaneously. A repeater is a full-duplex system because it receives and transmits simultaneously. A full-duplex autopatch allows you to talk and listen simultaneously.

Half-duplex means that information flows in only one direction at a time, even if the transmit path is on a different frequency from the receive path. Most radio transceivers are half-duplex devices. You can either transmit or receive, but not both simultaneously. Most autopatch systems operate in half-duplex mode, not because the repeater and autopatches can't receive and transmit simultaneously, but because the users can't.

Simplex operation refers to the fact that both transmitting and receiving take place on the same frequency, but not simultaneously. You need only a transceiver for this, not a repeater. A simplex autopatch, after activation, transmits the audio coming from the phone line. Every second or so, the simplex autopatch switches the transceiver from transmit to receive for a very brief time, typically 25–75 milliseconds. If a signal is received during this "sample window", the autopatch will hold the transceiver in receive mode until the signal ends, at which time the transceiver will be switched back to transmit mode.

A station listening to a simplex autopatch will hear the person on the phone line interrupted by a "click" every second or so. That's the sample window. To capture the receiver, the transmitting station must hold his transmitter on until a sampling occurs. Then he can talk to the person on the phone. Though it doesn't have the interactivity of a normal phone conversation, and has the annoying sampling interrupts, it gets the job done using only one frequency, and doesn't require a repeater. Anyone who has a transceiver can have his own autopatch. Be sure to check out the FCC regulations pertaining to simplex operation before putting such a system on the air.

73 Book Review

Wishbook of Circuits

Circuits for QRP, signal generators, and much, much more.

reviewed by Larry Antonuk WB9RRT

Master Guide to Electronic Circuits
by Harry L. Helms
Published by Prentice-Hall
Englewood Cliffs, NJ 07632
Hardbound, 293 pages, illustrated, 1988

The latest entry in the "circuit compilation/wishbook" category comes from Harry Helms. *Master Guide to Electronic Circuits* is a collection of electronic schematics, each backed up with a short paragraph of explanation. This type of book is quite useful for the person searching for a specific type of circuit. The original source is listed with each circuit, so the builder can go back and find PC board layouts, pictorials, etc. The book also fits the casual reading category—nice for browsing through, for thinking that well, someday, I'd sure like to build one of *those*.

The circuits contained in the *Master Guide* are drawn from several sources. Most of the information comes from manufacturer's data sheets and application notes. Hams will like the fact that the remainder of the circuits come from *73*, *CQ*, *Ham Radio*, and *QST*. As a matter of fact, these are the only magazines that the author drew from. This makes for a pleasing absence of Flashing-LED and Freezer-Failure-Alarm circuits.

In addition to the expected signal generators and QRP transmitters, though, we do have enough variety to make things interesting. The strong of heart can whip up their own Computer Modem or Bicycle Mileage Computer. Part-time medical doctors might want to build an Electrocardiograph Amplifier, or perhaps a Heart Rate Monitor. Or how about Automatic Cruise Control? You name it, it's probably in there.

The graphics in *Master Guide to Electronic Circuits* are quite good. The preface lets us know that the schematics don't all match one another because they are still in the style used by each publisher. While this comes across as a light apology, it's actually stating a strong point. Using material directly from the source eleminates another step in the process that could easily introduce errors.

Master Guide, being a good collection of the most current electronic circuits, is a source of inspiration. Used in conjunction with the originally published material, it will save the builder hours of research time. ■

Kenwood 4100A Crossband Repeater Operation

Turn this mobile rig into a mini-repeater.

by Bob Witmer W3RW.

Many of us are fascinated by, and find very convenient to carry, the new, very concealable hand-helds. Trouble is, they, like any hand-held, have a limited range, and many areas still have sparse repeater activity. Very often, repeaters accessible from a mobile rig are not so from an HT.

What to do? Well, if you own the Kenwood TW-4100A dual band mobile rig, you can make your own crossband repeater! You can enjoy simplex-to-simplex, and simplex-to-repeater, operation in addition to dual-band mobile operation. All this in a package that doesn't cost an arm and a leg!

How? It's one of the better kept secrets in FM Hamdom today: The Kenwood 4100A, along with its advertised features, has built-in crossband repeat capability. It works by the receiver scanning back and forth between the two bands and initiating crossband transmit when it detects a signal. When the signal drops, it resumes scanning. (It has a built-in, three-minute transmit timer.)

Although Kenwood's sales brochure vaguely refers to this feature, the 4100A manual does not mention it. Close examination of the schematic does reveal some circuitry labeled "RP," and a variable resistor, VR4, labeled "RPT," but none of the internal views indicate repeat mode components or circuitry.

I found out this capability was for real at a recent Hamfest where Paul, of Delaware Amateur Supply, mentioned that he had just received the 4100A repeat mode modification information from Kenwood and gave me a copy. However, the information in the "TW-4100 Repeater Operation Supplement", available to all from Kenwood, leaves out a few details. For example, it does not indicate that you need to adjust the repeat audio level (VR4), nor show where to make this adjustment.

The following describes what I have discovered about implementing and operating this mode.

"You can enjoy simplex-to-simplex, and simplex-to-repeater, operation in addition to dual-band mobile operation."

Hardware Mod of the 4100A

Modification requires the addition of one internal jumper between two posts. To do this, first remove the screws from the top and bottom covers of the rig. Take care when removing these covers, especially the bottom cover, as the speaker cable is attached to it. Then, just prepare a jumper wire about 3½" long, strip a small bit of insulation off the ends, and jump the two RP posts shown in Figure 3. That's it!

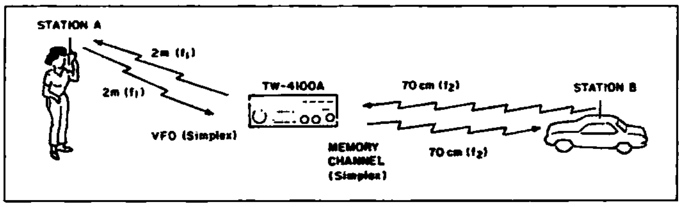


Figure 1. Simplex-to-simplex operation. In this mode, each band has the same frequency for both input and output.

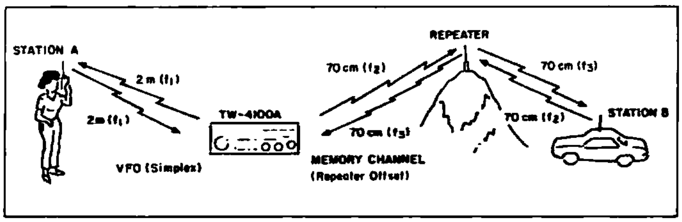


Figure 2. Simplex-to-repeater offset operation. In this mode, one band has the same input and output frequency, and the other band has differing input and output frequencies.

Well...Not Quite

Sometimes during repeater crossband operation, the TW-4100A may not detect a UHF signal while scanning between the two bands. This happens because the electric field generated by the strong UHF receiving signal cause the busy circuit to malfunction. Fortunately, there is a modification that will take care of this internal RF feedback problem. With less than $5 worth of components and a half-hour's worth of time, you can insure detection of the UHF signal. Best of all, this mod may be covered under warranty! (Get details on this from Kenwood.)

Refer to Figures 3 and 4. First, remove the covers as outlined above. Then, locate connector number 12 on the composite unit (RX-TX) on the bottom of the transceiver. Now, carefully strip ⅛" of insulation from the wire attached to pin 2 of connector 12, approximately ¼" from the connector. 6. Solder the three components, shown in Figure 4, between the wire and ground. A good ground location is the can around TC2 and L8. The mod is done—just carefully replace and resecure the two covers. Don't forget to adjust VR4.

Key-Step Programming

The following shows the series of keystrokes and control

adjustments you need to make, after the hardware mods, to get the 4100A up and running as a crossband repeater.

1. Press the VFO/M.CH key to select the Memory Channel mode.

2. Select the desired Memory Channel after programming the Tone Frequency and the Offset frequency. Any channel may be used except odd, split memory channels 8 and 9.

3. Press the VFO/M.CH key to return to the VFO mode.

4. Select the desired operating frequency for the other band. For example, if the Memory Channel you selected contains a two meter frequency, then choose a 70 cm frequency in this step. (See Section 4-2-4 and the MHz key section on page 8 of the operator's manual.)

5. Adjust the SQL control to the threshold point for each band.

6. Select the DUP shift mode using the SEL key and the TUNING control. (Refer to section 4-2-5 in the manual.)

7. If you have the VFO frequency programmed as the one that will activate the remote repeater site, you should select the desired tone frequency and transmitter offset frequency at this time. (Refer to sections 4-2-6 through 4-2-8 in the operator's manual.) Note: For simplex-to-simplex operation set 0.0 MHz for the transmitter offset frequency.

8. Press the SHIFT key. (The DUP indicator will turn ON>.)

9. If you have the VFO programmed to activate the remote repeater and a subaudible tone is required for access, you should press the TONE key.

10. Turn the POWER switch OFF.

11. Press and hold the REV key and turn ON the POWER switch.

12. Release the REV key. A beep will sound and the radio will now operate as a crossband repeater. The receiver will alternate between the two bands continuously. If squelch opens on one band, the corresponding incoming signal will be automatically retransmitted on the other band.

Note: If the transmitter remains keyed for longer than three minutes, the transmitter will unkey, and the receiver will begin alternating between the two bands to search for an incoming signal. This protects the finals and functions as a built-in time-out timer.

13. To cancel repeater operation, turn the POWER switch OFF. When the radio is again switched ON, the radio will return to normal transceiver operation.

14. Adjust VR4, the repeat audio level pot, shown in Figure 3. IMPORTANT: This is not the VR4 shown on page 28 of the 4100A manual.

15. Set repeat audio level. The best setting I found was at approximately ¾ full clockwise rotation.

16. Disconnect the microphone when in this mode, otherwise the mike is "live," and, when the transmitter is activated, local audio mixes with the repeat audio. You can use this path to mix in CW ID audio.

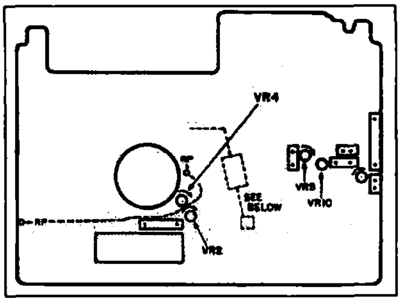


Figure 3. This shows both the repeater function mod and the mod to prevent RF feedback on UHF.

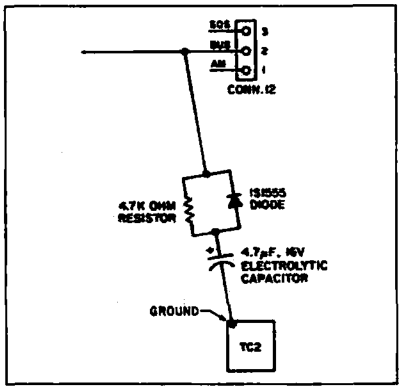


Figure 4. Schematic of the modification that ensures detection of the UHF signal.

Operating Considerations

The 4100A is not designed for continuous high power transmit operation. Consider the heat-dissipation environment of your rig's installation. The typical mobile installation on a hot summer day does not provide an ideal environment! If you are operating from a base power supply, be sure also to check its ratings.

> **"The 4100A is not designed for continuous high power transmit operation."**

The three-minute timer actually runs closer to two minutes and 15 seconds. At the end of the time-out period, the transmitter is interrupted for a moment, and the receiver resumes scan mode. This initiates the transmit cycle again.

The tuning control, and all keys, including the PTT and UP/DWN switches of the microphone, do not function while the TW-4100A is operating as a repeater.

When the DCL System is operating, Code Squelch Operation is automatically activated, and the TW-4100A operates as a Digital Code Access Repeater. In other words, you can't access the repeater function unless you transmit the proper DCS code.

Typically, I use the two meter simplex to 440 MHz repeat mode, and I have adjusted the 440 (70 cm) low power level (VR5) to 20 watts, and the two meter setting to 2 watts. This minimizes power dissipation in the unit because of the 4100A's "Carrier-drop" mode, which tends to keep the transmitter keyed up for long periods due to the courtesy beep, time-out timer reset mode of most repeaters. See the 4100A manual, Figure 1, page 28, for the description and location of these adjustments.

During operation, keep in mind the scan style mode of the 4100A. Autopatch operation is a good example of this limitation. The typical result of initiating an autopatch call in this mode is the eventual time-out of the patch—once the patch is activated, it looks for signals from your transmitter. Unfortunately, the receiver of the 4100A still sees the repeater transmitter carrier, thereby preventing transmit operation.

Information is also now available on how to expand the UHF frequency range to 420 MHz, and the VHF range from 141 to 151 MHz. To do this, however, you first need to contact Kenwood. Also make sure to review these sections of Part 97 all which concern repeater operation, before operating the 4100A in repeater mode:

Section 97.65 Specifies excluded frequencies

Section 97.67(c) Specifies power output limitations

Section 97.85(e) Details control operator requirements

Section 97.86(d) Concerns Auxiliary operations.

Acknowledgement

Many thanks to Don W3LR for his patience and cooperation in allowing his 440 MHz repeater to be used to evaluate this modification. Thanks also to Kenwood for permission to reprint information from their "TW-4100 Repeater Operation Supplement" and Service Bulletin #926 (dated 12-17-87).

One further mention: The TW-4100A can be modified for MARS (Military Affiliated Radio System) and CAP (Civil Air Patrol) operation. This simple mod requires no component additions to the rig. For instructions on this mod, send to Kenwood a copy of your current amateur license and a copy of the documentation approving you for operations in these services.

The crossband mode of the Kenwood 4100A provides an operational capability that is typically unavailable in a package this compact and low-priced.

[illegible] for Anti-RF Feedback

[illegible]

Ultimate Repeater IDer

Choose from a library of repeater IDs in either CW or Voice.

by P.J. Ferrell K7PF

Every amateur transmitter must be routinely identified—including repeaters. A solid state CW generator issuing the ID in Morse code has been the most commonly used. ID tapes are also used—I recall one famous repeater in Central Washington which had an ID tape featuring a voice so seductive that visitors routinely tried to date the ID generator! And, recently, computerized repeater controllers use a speech synthesizer, a solid state device with high reliability.

Thus, any ID generator claiming to be ultimate now should be a solid-state unit that offers both CW and voice, and allows free selection of messages. Figure 1 is a block diagram of the new repeater that uses the ID generator described in this article.

Digital speech comes in many flavors, from near-perfect digital recorders to hard-to-understand phoneme synthesizers. High quality digital speech requires about 8000 8-bit samples per second (64 K-bit PCM). Thus, a 32 K-byte EPROM could hold about 4 seconds of speech of this quality. Data compression techniques, such as Adaptive Delta Modulation (ADM) and Linear Predictive Coding (LPC) have been applied to lower this storage requirement. National Semiconductor and Motorola make ADM chips offering high quality speech with up to an 8-fold reduction over PCM. Texas Instruments makes an LPC chip offering up to an 80 to 1 reduction over PCM (or 10 to 1 over ADM). The same 32 K-byte EPROM could hold up to 30 seconds of ADM speech or up to 5 minutes of LPC speech. The TI LPC Voice Synthesis Processor (VSP) can make both voice and CW sounds, and is the one most commonly found in computerized controllers for amateur repeaters. Efficient speech coding methods such as LPC require substantial signal processing prior to data storage, so that the vocabulary is normally limited to that provided by the chip maker. If this limitation can be overcome, then our "ultimate" identifier will use the TI VSP chip ("TMS5220C Voice Synthesis Processor Data Manual," Texas Instruments Incorporated, Copyright 1982).

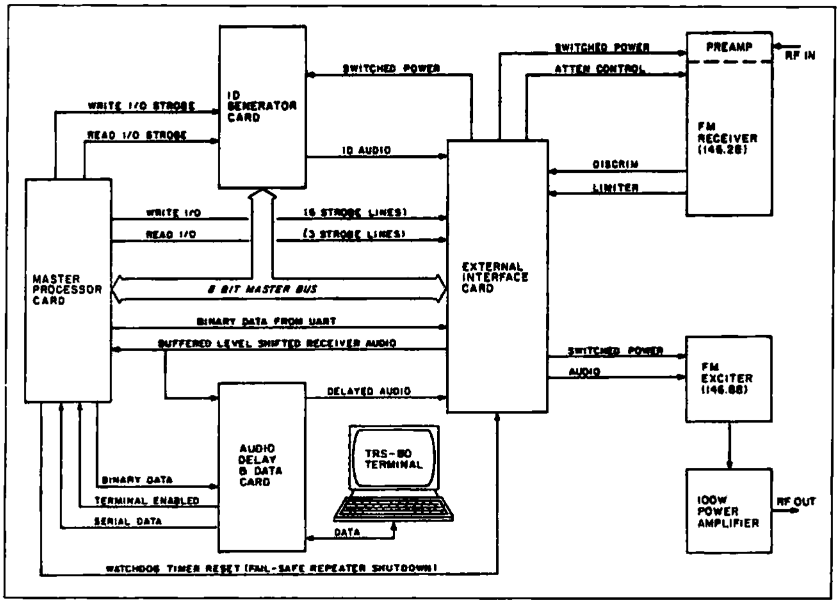


Figure 1. Repeater system block diagram.

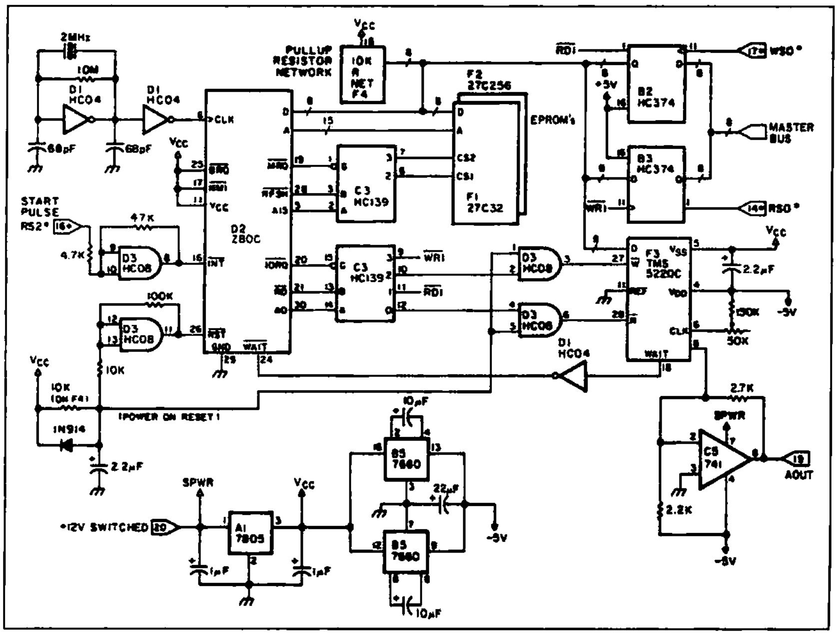


Figure 2. ID Processor schematic.

LPC Speech

The details of LPC processing are beyond the scope of this article, but the principle can be clearly understood. Human speech waveforms tend to be predictable (low entropy) signals. Given a series of samples of such a waveform, the next sample can be estimated quite accurately with past data. This calculation is performed at both transmitter and receiver. The transmitter sends only the ERROR, that is, the difference between the

actual and predicted sample values. The receiver simply adds the received ERROR to its own predicted value, giving the same sample value as that obtained by the transmitter. The better the prediction, the less data need be sent or stored. There is no approximation involved here, both transmitter and receiver get exactly the same series of samples (provided no transmission errors occur). This is a form of data compression coding known as "redundancy removal."

The TI TMS5220C VSP does its job by implementing a time varying tenth-order digital lattice filter which models a human vocal tract. This filter is excited by pitch (voiced sound) or by hiss (unvoiced sound). The output of this filter drives an 8-bit digital-to-analog (D/A) converter to produce the synthetic speech waveform. Compressed speech data is processed as frames, with a constant frame rate of about 40/sec. There are five frame types: Voiced (50 bits), Unvoiced (29 bits), Repeat (11 bits), Zero Energy (4 bits), and Stop (4 bits). Using only Voiced frames (50 x 40 = 2000 bits or 250 bytes per second), our 27256 EPROM holds over 2 minutes of sound. In practice, Repeat, Unvoiced, and Zero Energy frames reduce the required storage by over half. This gives us the aforementioned five minutes.

Hardware

The TMS5220C VSP interfaces neatly with a TMS6100 Vocabulary ROM (VROM) chip. Several VROMs can be paralleled for a more extensive vocabulary, and only the VROM word address need be supplied to speak the word. In addition to VROM speech, the VSP can "speak external"—speech data can be loaded from an external processor. Since our "ultimate" design uses complete messages rather than single words, externally supplied LPC data is taken from a 27C256 32K CMOS EPROM. Since the host repeater is battery powered, the ID generator is turned off when not needed, which is most of the time.

In addition to the TMS5220C VSP, a microprocessor is needed to fetch data and operate the identifier. I chose a CMOS Z-80, along with 74HC CMOS logic, for minimum power consumption. Figure 2 is the ID generator schematic diagram. A parallel interface to the repeater's master processor is used. A pair of 74HC374 tri-state latches between the repeater 8-bit Master Bus and the ID generator, form a parallel interface. The repeater's master processor issues commands and reads status using these latches, which must remain on to avoid loading the master bus during ID power down. The TMS5220C VSP is implemented in PMOS logic and requires both plus and minus 5 volts. A series pass regulator (7805) provides +5 V from the switched +12 V, and a small switching supply (dual 7660s) produces −5 V. Analog speech output from the VSP is amplified and level shifted to 0-5 V for repeater audio compatibility using a type 741 op amp. The processor program is stored in a 27C32 EPROM, and all messages are kept in the 27C256 EPROM. No RAM is used at all. In the unlikely event of needing more LPC data storage, you can substitute a second 27C256 for the 27C32.

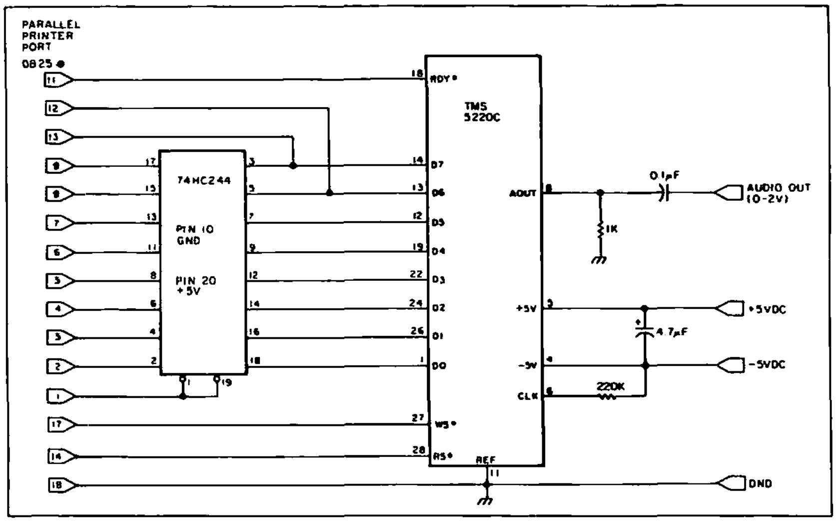


Figure 3. Speech Synthesizer development system.

Firmware

At power on, the power-on-reset signal momentarily lowers both READ and WRITE lines to the TMS5220C for an initial VSP reset. The Z-80 then begins, selecting interrupt mode (IM1) and setting the status latch to zero. A series of reset commands are sent to the VSP, status is set to 11H, and the processor halts with interrupts enabled. Upon receiving an interrupt pulse, execution begins at location 38H. A table of LPC data addresses and byte counts is referenced by the Z-80, and indexed using the requested message number. The table is located at the beginning of the 27C256, at Z-80 address 8000H. Each table entry consists of four bytes: the first two are the LPC data starting address, and the second two are the message byte count. A 2 MHz clock is assumed for the software timing loops. The following commented assembly language program listing covers the detailed operation of the Z-80C ID generator processor shown in Figure 2.

```
; * basic ID generator handler subroutine *
; turns ID power on, then latches in msg#
; if starts OK, exits leaving VSP running,
; else performs ID generator shutdown
;
STVSP:  PUSH    BC
        PUSH    AF              ;save msg#
        LD      A,40H           ;turn on..
        OUT     (EIDSC),A       ;..ID gen pwr
        POP     AF              ;latch msg#..
        OUT     (IDGEN),A       ;..to ID proc
;
        LD      BC,500H         ;loop count
SVSP1:  IN      A,(IDINT)       ;I/O pulse to the..
        DEC     C               ;..ID processor
        JR      NZ,SVSP1        ;..interrupt line
        DJNZ    SVSP1
        OUT     (WDOG),A        ;reset rptr watchdog
;
        LD      BC,1000H
SVSP2:  IN      A,(IDGEN)       ;get status
        CP      33H             ;VSP talking?
        JR      Z,SVSP3         ;yes
        DEC     C
        JR      NZ,SVSP2        ;not yet..
        DJNZ    SVSP2           ;..wait
;
        XOR     A               ;ID proc..
        OUT     (IDGEN),A       ;..didn't start
        LD      A,0BFH          ;shutdown..
        OUT     (EIDSC),A       ;..ID power
        JR      SVSP4
SVSP3:  XOR     A               ;clr ID..
        OUT     (IDGEN),A       ;..latch
        LD      A,0C4H          ;open ID audio..
        OUT     (EIDSC),A
SVSP4:  POP     BC
        RET
```

Table 1. This Basic ID generator handler subroutine illustrates use of the ID generator.

Master Processor Usage

To start an ID message, the repeater master processor powers up the ID generator and outputs a message number request. It then sends a set of interrupt pulses and waits a fixed amount of time for a "VSP is talking" status. Table 1 is an excerpt from the master processor's operational repeater program which illustrates use of the ID generator.

Speech Development System

If it were possible to "cut and paste" word sounds to make desired words, then virtually any message could be put together. Figure 3 is a schematic for the developmental system hardware which operates with the resulting frame editor. It uses a TMS5220C VSP and a single 74HC244 buffer chip, and plugs into any PC parallel printer adapter. An audio

Voice Synthesis Processor message # and sound

0	no message (resting value)	20	zero
1	sea.rpt.pwr.on reset check complete	21	one
2	de k7pf /r (in morse)	22	two
3	k7pf repeater	23	three
4	de k7nxo /r (in morse)	24	four
5	k7nxo repeater	25	five
6	de w7mhy /r (in morse)	26	six
7	w7mhy repeater	27	seven
8	de k7lzj /r (in morse)	28	eight
9	k7lzj repeater	29	nine
A	de n7abe /r (in morse)	2A	ten
B	n7abe repeater	2B	eleven
C	seattle rptr.green stn.(in morse)	2C	twelve
D	sea.rptr. green stn.	2D	thirteen
E	from hi stop green stn.	2E	fourteen
F	please identify	2F	fifteen
10	that's it!	30	sixteen
11	on emergency power	31	seventeen
12	data transmission	32	eighteen
13	time out	33	nineteen
14	sunday brunch	34	twenty
15	sunday pizza bash	35	thirty
16	complete	36	forty
17	repeater active	37	fifty
18	repeater inactive	38	bye . . .
19	data load	39	ready
1A	off frequency	3A	merry xmas
1B	the time is	3B	happy new year
1C	hours	3C	low deviation
1D	minutes		
1E	seconds		
1F	exactly		

Table 2. Partial message for the Seattle repeater shows the voice synthesis processor message # and sound.

amplifier to drive a speaker can be added, but the VSP audio output is of sufficient level to drive most headphones. The frame editor loads LPC code and permits deletions, additions, and changes to any parameter of any frame. The resulting code can be sent to the VSP for listening evaluation. When done, the LPC data can be written to disk as a file for later use as a sound, a word, a phrase, or a complete voice message. The LPC data can be laid out in PC memory, a message table constructed, and the whole thing burned into EPROM for use in the identifier. A partial message table for the Seattle Repeater is shown in Table 2.

Morse messages run longer than the voice version, and thus use many more frames. Only one Voiced (50 bit) frame is needed to set CW tone pitch; all other Morse frames are the short Repeat (11 bit) or Zero Energy (4 bit) frames. Curiously, the LPC data storage is about the same as that for the equivalent voice message. Synthesizer frame timing (40 frames/second) restricts achievable code speed to 36 WPM divided by an integer. We selected 18 WPM, as 36 WPM is too fast, and 12 WPM is too slow.

LPC Data Editing

LPC data is stored in bytes, but the VSP converts it to frames for generating sound. Any LPC data editor must deal with frames instead of bytes, so the editor converts stream-to-frames and frames-to-stream as required. The editor reads a disk file in bytes (stream) and stores it as frames. Frames may be added, deleted, or modified as needed. Other sounds (from other files) may also be added. At any time, the frames in work may be sent (converted back to stream) to the VSP for a listening evaluation. Two frames within the data can be designated (cursor and mark) to define a "block" of frames. The VSP sounding options are: start to end, start to cursor, cursor to end, and start to end, omitting the marked block.

For example, we needed the word "SEATTLE." The following sounds were used: the spoken "C," the word "at," and the word "all." The first cut sounded like "see at all," rather than the desired word. Accent is a matter of amplitude and duration, however, with easy control of these parameters using the editor. The final version of "SEATTLE" sounds as good as any word in the LPC vocabulary. Each finished word may be stored as a binary (stream) file on disk for later use in creaating an entire message. Both byte count and frame count are given by the editor. In order to greatly simplify control of the identifier, each message is stored in ROM completer and ready to speak.

Conclusion

Texas Instruments' LPC VSP product line is being upgraded, so TMS5220Cs may be in somewhat short supply. We recommend starting this project with the PC-based speech development system shown in Figure 3. If you can make the TMS5220C generate voice and CW messages to your liking, the rest is pretty standard stuff. The parallel interface can be easily modified, perhaps using a PIO/PIA, or even changed to a serial interface using a UART. The details will depend on access to the repeater control processor.

A copy of the LPC Frame Editor is available to radio amateurs on an IBM compatible DOS floppy disk. TI has graciously allowed us to include a selection of LPC encoded words, along with some phrases we have found useful, each a separate archived file. Documentation and test software is also included on the disk, which is intended for amateur radio use only. The disk is $27 postpaid. Contact *RadioRose Consortium, 6021 S. 119th St., Seattle WA 98178.* ■

```
                 ; * * * * * * * * * * * * * * * * * * * * *
                 ; *  ID Processor Operational Program     *
                 ;  *          K7PF - 02/01/87             *
                 ; * * * * * * * * * * * * * * * * * * * * *
                 ; - command from MPROC is desired msg #
                 ; - status code back to MPROC is:
                 ;       00 - at power on
                 ;       11 - reset & init complete
                 ;       22 - no such message
                 ;       33 - VSP is talking
                 ;       55 - normal completion code
                 ;       FF - immediately after interrupt
                 ; note: MPROC ** MUST ** clear ID cmd latch
                 ;       prior to generator power down:
                 ;
                 ;   EQUATES:
                 ;
0000             TMS     EQU     0H          ;TMS5220 R/W
0001             LATCH   EQU     1H          ;I & O LATCHES
8000             TABLE   EQU     8000H       ;32K
                 ;
0000                     ORG     0H
                 ;
0000 ED56        START:  IM1                          ;intrpt mode 1
0002 3E00                LD      A,00H                ;pwr on..
0004 D301                OUT     (LATCH),A            ;..val
0006 3E70                LD      A,70H                ;reset VSP..
0008 0E10                LD      C,10H                ;..16 times
000A D300        RSVSP:  OUT     (TMS),A
000C 0632                LD      B,32H                ;Twait = .
000E 10FE                DJNZ    $                    ;..300 uS
0010 0D                  DEC     C
0011 20F7                JR      NZ,RSVSP
0013 3E11                LD      A,11H                ;init done..
0015 D301                OUT     (LATCH),A            ;..val
0017 FB                  EI
0018 76                  HALT
                 ;
                 ; ICROM program signature:
                 ;
0020 4B375046            DB      'K7PF - 02/01/87 '
                 ;
                 ; code executed following interrupt (mode 1)
                 ;
0038                     ORG     38H                  ;INTRPT
                 ;
                 ; note that reading LATCH also writes an FF to output
                 ;
0038 DB01                IN      A,(LATCH)            ;write FF & get msg#
003A 010080              LD      BC,TABLE             ;table base
003D 6F                  LD      L,A                  ;msg# in..
003E 2600                LD      H,0                  ;..HL
0040 29                  ADD     HL,HL                ;x2
0041 29                  ADD     HL,HL                ;x4
0042 09                  ADD     HL,BC                ;add table base
0043 4E                  LD      C,(HL)               ;load BC..
0044 23                  INC     HL                   ;...with LPC
0045 46                  LD      B,(HL)               ;...data offset
0046 23                  INC     HL
0047 5E                  LD      E,(HL)               ;load DE..
0048 23                  INC     HL                   ;..with LPC
0049 56                  LD      D,(HL)               ;..bytecount
004A 78                  LD      A,B
004B A1                  AND     C
004C 3C                  INC     A                    ;BC = FFFF ?
004D 3E22                LD      A,22H                ;load 'not found'..
004F CAB200              JP      Z,EXIT               ;...code & exit
0052 C38000              JP      RUN                  ;else proceed
                 ;
                 ; ID code resumes here:
                 ;
0080                     ORG     80H
                 ;
0080 210080      RUN:    LD      HL,TABLE             ;pointer to LPC..
0083 09                  ADD     HL,BC                ;...data in HL
0084 3E60                LD      A,60H                ;speak external.
0086 D300                OUT     (TMS),A              ;...command to VSP
0088 0600                LD      B,0
008A 10FE                DJNZ    $                    ;dly 1.5 mS for VSP
008C 3E33                LD      A,33H                ;notify mproc..
008E D301                OUT     (LATCH),A            ;..we're running
                 ;
0090 7E          TALK:   LD      A,(HL)               ;LPC data..
0091 23                  INC     HL                   ;...sent to
0092 D300                OUT     (TMS),A              ;...VSP
0094 10FE                DJNZ    $                    ;1.5 mS delay
0096 DB00        WBUF:   IN      A,(TMS)              ;get VSP status
0098 00                  NOP                          ;allow at least..
0099 00                  NOP                          ;..12 uS Twait
009A E640                AND     40H                  ;BL (buffer low)?
009C 28F8                JR      Z,WBUF               ;no, wait
009E 1B                  DEC     DE
009F 7A                  LD      A,D                  ;done?
00A0 B3                  OR      E
00A1 20ED                JR      NZ,TALK              ;no, send next
00A3 AF                  XOR     A                    ;yes, send .
00A4 D300                OUT     (TMS),A              ;..final null
00A6 10FE                DJNZ    $
                 ;
00A8 DB00        WTLK:   IN      A,(TMS)              ;get VSP status
00AA 00                  NOP                          ;insure TMS5220..
00AB 00                  NOP                          ;..Twait time
00AC E680                AND     80H                  ;TS (talk status) ?
00AE 20F8                JR      NZ,WTLK              ;yes, wait
                 ;
00B0 3E55                LD      A,55H                ;normal completion..
00B2 D301        EXIT:   OUT     (LATCH),A            ;..output code
00B4 FB                  EI                           ;just in case
00B5 76                  HALT
00B6                     END
```

Table 3. K7PF's ID Processor Operational Program.

Computerized Tuning for TS-830S

Control digital VFOs with your personal computer.

by Robert Fisher KF6DF

Pushbutton tuning has been around for some time—you now find this capability even on microphones! My Kenwood TS-830S is a rig with such capabilities—it has a digital VFO called the DFC-230 Frequency Controller. Two buttons on the top of the microphone control this VFO. Although I used my Kenwood TS-830S, this system works with any rig that uses scanning switches on the microphone.

I developed a scanning system that uses simple computer operations. It is a software program that generates tones to send to two tone decoder ICs. Each decoder controls the scanning of the band. An optical coupler takes the place of each microphone switch used for frequency scan. See Figure 1.

The Computer Hook-Up

I used the TRS-80C Color Computer to generate the audio for the PLL tone decoder chips. Any computer that generates audio through software programming, however, will work. Use the audio output either from the monitor's earphone jack, or from the audio input to the RF module in the computer itself. A shielded cable connects to the input of the 567 PLL ICs.

The Computer Program

Most computers can use a simple BASIC loop program for this system. A tone that activates one PLL is used for up scanning, and another tone is used for down scanning. BASIC commands preselect the tone frequencies. Each loop cycle generates a tone pulse. When using the frequency controller, a pulse changes the frequency by 20 Hz. Thus, five pulses change the frequency by 100 Hz, the smallest frequency unit displayed on most rigs.

Leaving the tone on for more than a few seconds switches the unit to fast scan, allowing rapid frequency change. The user can select 20, 100, and 1000 Hz steps, and fast scan. (See Figure 5.) In BASIC, the INKEY$ function scans the keyboard for the selected keys, and branches off to the loop that selects the scanning increments. Additional loops change tone frequency for minor variations or drift in the PLL locking frequency. Thus, if the PLLs were first set to 1000 and 2000 Hz, and drift, tapping the up or down arrow slightly shifts the high tone. Hold down the Shift key for the low tone adjustment.

Controller Hook-Up

The PLLs drive optical couplers. (See Figure 2.) These couplers are made from an infrared LED and a photo transistor held together with shrink tubing. Two of these units are needed. The cable is soldered to the 8-pin connector plug used for the DFC-230 Frequency Controller. See Figures 1 and 3.

Using the Computer

I found this method of computer-controlled scanning easy to use and adaptable to other computers. This is because only tones control the scanning system. You can also use a variety of rigs—with no modifications needed—with this system. Just buy the proper plug seen on the end of the microphone cord. The user can wire the microphone plug in parallel and scan the band manually, as well as by

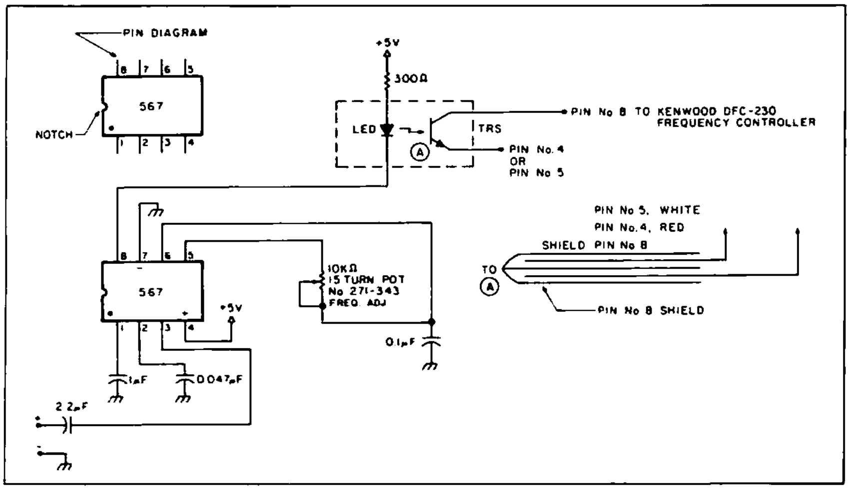


Figure 1. Schematic for computer/TS-830S transceiver interface. Circuit can be modified for use with other transceivers.

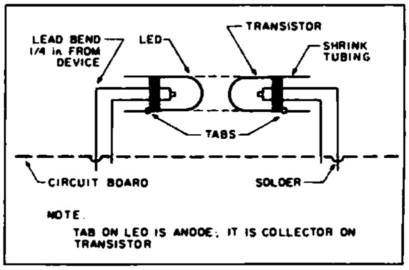


Figure 2. LED and optical detector mounting and orientation.

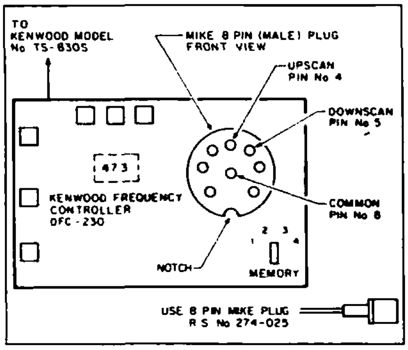


Figure 3. Details of pin signals from Kenwood DFC-230 frequency controller.

computer. By wiring a stand-up microphone into the plug, the operator can use computer control of scanning while he talks. He can fine-tune his signal in 20 Hz increments with Receive Incremental Tuning (RIT) while holding the transmit frequency constant. This fine-tuning procedure works well on RTTY, AMTOR, packet, and SSB.

"SPACE BAR" tunes in 100 Hz steps. The "@" key performs 1 kHz frequency changes. The "F" key selects fast scan when going from the AMTOR or RTTY, to packet subbands.

VFO Tuning Interface Parts List

Quantity	Item	RS Part #
2	567 PLL ICs	276-1721
1	Circuit board	278-168
1	Mike plug, 8-pin	274-025
1	Optical diode, detector pair	276-142
2	10kΩ 15-turn mini pot	271-343 or
2	10kΩ 270° pot	271-218 or
2	5kΩ 270° pot	271-217
2	2.2 µF (25 VDC) capacitor	
1	0.1µF disk capacitor	
1	0.047µF disk capacitor	
1	1µF (10 VDC) capacitor	
2	1" long, ½" dia. heat shrink tubing	

Table 1.

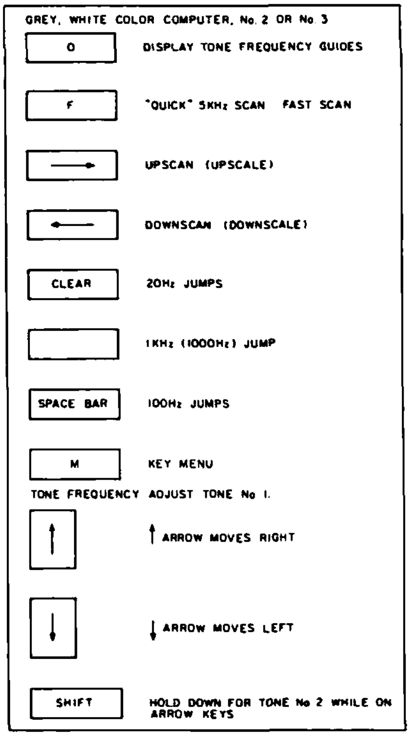


Figure 5. Keyboard function reference guide.

```
10 REM-TUNING PROGRAM
20 FU=236:REM-HIGH TONE,UPSCAN
30 FD=233:REM-LOW TONE,DOWNSCAN
40 M=1:N=1
50 CLS:PRINT"PRESET TUNING:":PRINT
60 GOTO 330
70 REM-KEYBOARD SELECT FUNCTIONS
80 A$=INKEY$
90 IF A$="M" THEN GOSUB 470
100 IF A$=CHR$(12) THEN M=1:N=1:CLS:PRINT"20 HZ STEPS"
110 IF A$=CHR$(32) THEN M=1:N=5:CLS:PRINT"100 HZ STEPS"
120 IF A$=CHR$(9) THEN 240
130 IF A$=CHR$(8) THEN 280
140 IF A$=CHR$(64) THEN M=25:N=1:CLS:PRINT" FAST TUNE 1KC STEPS"
150 IF A$="F" THEN M=82:N=1:CLS:PRINT"FAST TUNE 5KC STEPS"
160 IF A$=CHR$(95) THEN FD=FD+1:CLS:GOTO 330
170 IF A$=CHR$(91) THEN FD=FD-1:CLS:GOTO 330
180 IF A$=CHR$(64) THEN N=50:CLS:PRINT"1 KC STEPS":M=1
190 IF A$=CHR$(10) THEN FU=FU-1:CLS:GOTO 330
200 IF A$=CHR$(94) THEN FU=FU+1:CLS:GOTO 330
210 IF A$="D" THEN CLS:GOTO 330
220 GOTO 80
230 REM-TONE GENERATOR LOOPS M IS THE LENGTH OF THE TONE AND N IS THE NUMBER OF
REPEATS.
240 FOR I= 1 TO N
250 SOUND FU,M
260 NEXT I
270 GOTO 80
280 FOR I= 1 TO N
290 SOUND FD,M
300 NEXT I
310 GOTO 80
320 REM TUNING GRAPHS
330 PRINT:PRINT"TONE FREQUENCY ADJUST":PRINT
340 FOR I=FD-3 TO 240
350 IF I=FU THEN PRINT CHR$(94);
360 PRINT CHR$(42);
370 NEXT I
380 PRINT "UPSCAN"
390 PRINT:PRINT
400 FOR I=226 TO FU+3
410 IF I=FD THEN PRINT CHR$(94);
420 PRINT CHR$(42);
430 NEXT I
440 PRINT"DOWNSCAN":PRINT:PRINT"UP OR DOWN ARROW-HIGH TONE        SHIFT/UP OR DOWN
 ARROW-LOW TONE"
450 GOTO 80
460 REM-MENU PRINT SUBROUTINE
470 CLS:PRINT@75,"KEY MENU"
480 PRINT@128,"D-DISPLAY TONE FREQUENCY SCALE"
490 PRINT@160,"F-FAST 5KC SCAN"
500 PRINT@192,"@-1 KC JUMP"
510 PRINT@224,"SPACE BAR-100 HZ JUMPS"
520 PRINT@256,"RIGHT ARROW-UPSCAN"
530 PRINT@256,"CLEAR-20HZ JUMPS"
540 PRINT@320,"LEFT ARROW-DOWNSCAN"
550 PRINT@352,"RIGHT ARROW-UPSCAN"
560 PRINT@416,"UP ARROW-HIGH TONE,INCREASE"
570 PRINT@448,"DOWN ARROW-HIGH TONE,DECREASE"
580 PRINT@480,"SHIFT/ARROW-DITTO FOR LOW TONE"
590 RETURN
600 END
```

Figure 4. BASIC tuning program for CoCo. Any computer that can generate audio tones can be used as a controller.

The Circuit

The builder can wire the circuit on a pre-drilled circuit board, as shown in the parts list. It uses two 567 PLL tone decoders. Each one switches on the infrared LED. This turns on the photo transistor, which lowers resistance across the pins shown to start the scanning process. Each 567 PLL is adjusted to the frequency selected for up or down scanning. Pin #8 pulls low when the program selects the proper tone. You can select any tones between 1 and 2 kHz. They can be as narrowly spaced apart as 200 Hz. See Figure 1.

The power supply is a simple 5-volt regulated supply. I used a plug-in transformer with a rectified DC used for portable calculators. A three-pin regulator provides 5 volts.

Conclusion

I found this system very simple and easy to use. I did not have to make any modifications to the rig or the frequency controller. All you need to do is trace the wires from the microphone scanning switches to the pins on the microphone plug. The photo switching transistor should be sufficient to jump the switches. If not, use a reed relay instead.

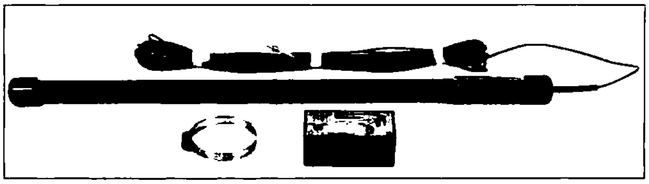
So, enjoy building this simple system! It's a nice one-evening project, and who can resist having another neat gimmick to show off in the shack? More importantly, this project should help take away some of the mysticism and fear you may have about interfacing microcomputers with ham gear.

73 Review *by Larry R. Antonuk WB9RRT*

LF Engineering L-101S Receiving System

Fast and easy way to receive on the 1750m band!

LF Engineering Company, Inc.
17 Jeffry Road
East Haven, CT 06512
Price: $120



The LF Engineering L-101S 1750m receiving system.

Ham radio operators, by their very nature, like to explore. "Tuning around" and becoming familiar with a new band is one ot the more pleasurable aspects of amateur radio. The lack of activity on some of the less common bands is mainly due to one problem—the difficulty of obtaining the necessary equipment. The necessary investment of time and/or money is often too great to justify. While you can often either borrow or build equipment for new bands, either solution has its drawbacks. Finding commercial hardware becomes more and more of a problem the further away from 80–10 meters you want to operate.

The 1750 meter VLF band is one such obstacle. Also known as the Experimenter's Band, it is, by definition, the domain of the home-brewer. "1750 meter appliance operator" is the original oxymoron!

What to do to just "tune around" on 1750 meters? What if you've been introduced to 1750 meters, and want to get active, but just don't have time to wind all those coils? What if all this talk of ground resistance, top hats, and Litz wire is just too overwhelming for the time being?

LF Engineering Company, Inc., has a simple solution to these problems. The L-101S Receiving System is a combination of active antenna and receiving converter. Used in conjunction with a 3.5 to 4.0 MHz receiver, the system provides coverage from 3 to 530 kHz with no antenna tuning required.

The heart of the L-101S Receiving System is the new L-400B Active Antenna. Housed in a 26" x 1" sealed PVC probe, the antenna comes with a 50-foot RG-174/U cable. The L-400B represents a breakthrough in LF antenna technology—a field sensitivity 20 dB greater than the original L-400, with equal or greater broadcast intermodulation rejection. These figures are possible due to a proprietary design 18 dB amplifier and a lumped-constant low-pass filter, both the result of several months of research and development. The dynamic range of the L-400B is 110 dB, and it can operate in the linear region with signal levels of up to 200,000 microvolts. Extended RF and ESD protection is included.

The L-101B VLF Converter makes up the rest of the receiving system. The converter comes housed in a 4" x 2" x 1.5" box, and uses RCA-style connectors. The unit covers 2 to 500 kHz with no returning, and produces either 3.5 to 4.0, or 4.0 to 4.5 MHz outputs. Powered by a standard nine volt battery, the unit will operate for one year before replacement is necessary. The L-101B was designed with a JFET mixer to provide a higher than normal input impedance, resulting in higher gain and wider dynamic range, without compromising intermod rejection.

Using the receiving system couldn't be easier. The antenna is easily clamped to almost any existing structure. The RG-174/U cable is thin enough to be easily concealed. Antenna cable is included, but the converter to radio cable is not. In most cases, this will be a male RCA to PL-259 jumper. Once you're connected, the system is operational. Simply tune across the 80 meter band to hear a variety of operators, beacons, and airports.

Or, in my case, light dimmers, electric fans, and thunderstorms! I guess this means I'll have to be patient enough for winter to come—but at least I'll have enough time to get my VLF transmitter on the air! 73

Number 37 on your Feedback card

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon, OH 44646

Back to Solar Power

This month we'll get back to solar power for your shack. In the past I've mentioned operating a ham station directly from a solar panel and battery. Energy storage is the key to successful solar electric operation. You should not connect a solar panel directly to your radio, since the open voltage of most solar panels is well over 20 volts. The results can just ruin your day. To operate directly from the sun's power, without battery storage in the circuit, use a small voltage regulator.

The circuit I used in the QRP 5'er works quite well. (Feb. '88 *73*) Of course, you don't need the transformer/diode setup if you're not using 110 volts, but I would keep the filter capacitor. It adds a small amount of storage, since it holds a charge. This allows for a slight drop in output from the solar panel, which occurs now and then as the clouds pass by overhead.

With the modified version of the QRP 5'er, you can operate standalone solar power. For a much simpler circuit, you can use a three-terminal voltage regulator chip. These chips handle up to one amp of current, and are quite small. You could easily install one inside a radio.

To use the regulators that come off the shelf at the local Radio Shack, you'll need to raise the ground lead above ground. This increases the output voltage of the regulator. For example, inserting two diodes in the ground lead of a 12 volt regulator will raise the output by 1.4 volts. A small voltage divider made of resistors will do the same thing. The object is to raise the voltage high enough to operate the radios. A good starting point is 12.6 volts, perhaps a tad higher. Of course, using either method, you can't operate at night or on cloudy days.

Ideal Conditions for Peak Power

When people talk solar power, the conversation always drifts to peak power. This is the amount of power a photovoltaic device can be expected to produce at solar noon on a cold, clear day under full, bright sun. The standard test for a photovoltaic cell was designed by the DOE (Department Of Energy) and the Jet Propulsion Laboratory. The standard test for peak watts include a cell temperature of 25°C, an insolation of 1000 watts per square meter, and an air mass of 1.5. Insolation, by the way, is the amount of sunlight striking the earth.

We now have to add two more conditions to our PV system. These are the nominal operating cell temperature and standard operating conditions. Nominal operating cell temperature is the temperature reached by a cell while it is functioning under standard operating conditions. Standard operating conditions include insolations of 800 watts per square meter, air temperature of 20°C, and a wind velocity of 1 meter per second. The panel would be oriented toward solar noon. The panel is measured open-circuit voltage.

What does all this mean? In the real world, we almost never find ourselves under full sun conditions. The ambient temperature is always higher, making the normal cell temperature much higher than expected. The results? The peak power of our panel will normally be reduced. If you purchase a 37 watt panel, you'll see about two-thirds of the potential output. On the other side of the coin, under better-than-standard conditions, you'll see more power being generated than the panel should be producing.

The Tilt of the Array

Now that peak power is no longer a mystery, we can move on to peak sun hours. Under a normal day's sun, we only get an average of four to six hours of energy producing sunlight. The amount of time the photovoltaic array produces full power depends, on where you live. Here in Ohio, I get about 4.5 hours in the summer and about 3.1 hours in the winter.

When building a photovoltaic array consisting of several panels, consider the tilt angle of the array. In the past, I never worried too much about tilt angle. However, with the improvements I have made on my array, I started to see a drop in power as we moved closer to summer. A good rule of thumb for tilt angle would be to add the latitude plus 15 degrees. This orients the array toward the low altitude angle of the sun in winter when the least amount of insolation is available. This is 30 degrees away from the best "summer tilt." If your loads are greatest during summer, then by all means re-tilt the array for the summer loads.

Battery Charge Regulation

In a photovoltaic system, charge controlling protects the battery(ies) from over charging. For example, if you have a small panel and average size battery, and you place some type of load on the battery now and then, you don't need a charge controller. Using a 105 amp per hour battery with a 0.8 mA panel, and operating on the weekends, you won't need a charge control system. Thirty amps into a large battery array, however, does require charge controlling.

> *"Energy storage is the key to solar electric operation."*

There are two basic systems for battery regulation: relay and solid state transistor switching. The first type uses a relay to control the flow of current from the array. The second type uses a transistor switch. If the batteries are low, the control logic energizes the relay, or turn the transistor on, so current from the array can flow into the batteries. This is called series regulation. The control element—the relay—is in series between the array and the batteries. As charging progresses, the battery's terminal voltage rises. Using information from the battery manufacturer, you can approximate battery state of charge. The controller logic monitors the battery terminal voltage and decides when to stop the current flow by opening the relay or shutting off a transistor switch in a solid state series controller. In either relay or solid state series controller logic, the battery's terminal voltage flattens out near the end of its charge, and no longer accurately reflects the state of charge.

In a solid-state series regulator, the transistor must pass the full current from the array. Heatsink it well!

Shunt type regulators operate by diverting array power from the batteries as they reach full charge. This can be done in many ways, but the two most common methods are: shorting the panel to ground on the panel side of a blocking diode (switching shunt mode); and dissipating the energy as heat in the shunt transistor (linear shunt mode).

Energy Storage

The shunt mode controller has the advantage of allowing the batteries to float to maximum charge. This controller logic never completely stops the current flow. The series controller, however, stops all current when the battery voltage reaches full charge. Using only this one-step logic, the battery may never reach full charge. Most of the better series controllers also use a smaller, float regulator to charge the batteries the remaining 10% or so.

Usually the charging process stops just above the voltage at which electrolytic gassing occurs. This slight gassing mixes the electrolytes, which prevents their stratification and the consequent loss of battery capacity. Mixing the electrolytes is especially important in very large batteries, and that's where we'll pick up in the next column—energy storage and batteries.

In keeping with the theme of this column, I bought some small one- and two-watt Sovonic photovoltaic panels. They have no frame, but include a blocking diode. Both panels are flexible and quite rugged. Price for the one watt panel is $22.50, which includes postage in the USA and Canada. The two watt panel goes for $37.50. Power output for the one watt panel is 0.70 mA at 14.4 volts. Double the current for the two watt panel. I have only a few panels, so rush you orders.

Anniversary

This issue marks two years of QRP in *73*. I want to thank everyone who has sent in comments and photographs. There is quite a bit more coming down the pike. I hope to have some receiver projects soon. We will be doing more building, also. The DIY (Do It Yourself) keyer was a big hit.

Let's hear from you about your experiments with QRP and solar panels! 73

Life On A Megacycle

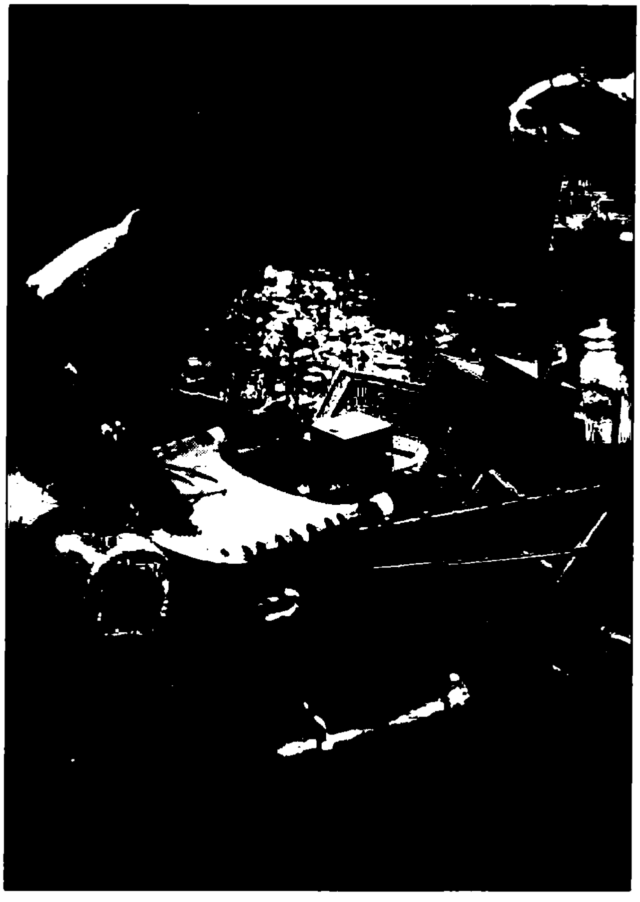
HF Aboard the Winnebiko

by Steven K. Roberts N4RVE

If you have been following these tales of my high-tech nomadness for awhile, you're getting a good image of the Winnebiko II—that 12-foot, 275-pound, 54-speed, solar-powered assemblage of gizmology that has become my electronic home. I've pedaled it 16,000 miles around the US, and am now hauling it to and fro in an old school bus, visiting hamfests and sponsors. Next spring, we'll hit the road again with a team of fellow nomads.

An increasingly important part of this life is ham radio. Not just the obvious convenience of two meters, but "classic" ham radio as well—HF. In this, the 9th article of our series, I'd like to discuss some of the issues involved in running 3-30 MHz while living full-time on the road.

Well, in last month's article I explored the various motives that drive us hams to do what we do. Near the end I admitted to feeling about a dozen of the seventeen mentioned . . . many of them quite strongly,given the sweat involved in making ham radio a part of my nomadic lifestyle. 2 meters, of course, is at the appliance/survival level—it keeps me in touch with Maggie, local hams, and the reassuring presence of autopatch facilities when I feel the need for security.



Steve Roberts N4RVE and the Winnibiko—A rolling caricature of the information age.

But what about HF?

First of all, why go through the hassle? Why haul a 25-pound "radio pack" up mountains? Why spend hours erecting dipoles just for the pleasure of uttering plaintive QRP calls into the cacophony of the airwaves?

Is there survival value in stringing a wet noodle in Montana trees, plugging together a few cables, and hunkering over a battered Argonaut while Maggie conjures camp glopola? Perhaps, in an extreme case, we might need medical help in the wilderness someday. But that's not what it's about, nor is it the pure fun of making contacts, nor the twisted pleasure in coloring in counties on my US map whenever I work a new one. And were it only the technical satisfaction of making an unlikely lash-up work, the thrill would have faded by my tenth QTH.

A Global Home

No, the value of this goes to the very heart of my wanderings, touching the same cravings that, five years ago, led me to trade my security for freedom and hit the road. A traditional home wasn't enough . . . I wanted a global one.

And, of course, it's now a question I hear almost every day: "What do you call home?" The answer has three parts . . .

On one level, home is the bike, the trailer, Maggie, and all the stuff we haul around with us. Home is also the whole world—a giant neighborhood that we prowl, visiting old friends and making new ones. But there's a third level, every bit as important as the other two: Dataspace. That's the vaporous global culture of electronically linked brains, made up of computer networks, BBS systems, the packet culture, and the planet-wide community of ham radio operators whose voices crackle through the bike's headphones whenever I say something like "N4RVE, bicycle-mobile QRP. QRZ?" Thanks in part to this series in *73 Magazine*, electronic doors open every time I go on the air and the security that comes from having an extended electronic family goes a long way toward delaying the urge to settle down.

But enough rhapsodizing. I get a lot of questions on the air about my bicycle-mobile HF rig, so here are a few details.

Pedaling The Megacycle

First of all, I should emphasize that this article comes at a time when the Winnebiko II

is undergoing major surgery...and will appear in a few months as the new improved Winnebiko III. The HF system is evolving along with everything else, and I have to resist the temptation to tell you about all of the NEW stuff before it's installed and working.

The heart of my present HF station is the Ten-Tec Argonaut 515 which, after a few months of flaky connectors, seems to work better and better the more it's abused. I carry an external audio filter, also by Ten-Tec, as well as one of Bob Heil's excellent headsets.

CW input is a function of whether or not I happen to be mobile. When in camp or visiting someone's house, I use the MFJ "Pacesetter" keyer, built around a smooth Bencher paddle. This is heavy, of course, with a steel block to keep it in one place on the desk. I'm machining a light aluminum base that can Velcro to a plastic work surface or snap onto the door of the HF area in the new trailer.

For CW mobile, I use the handlebar keyboard and a piece of Morse-generation softput to the bike's speech synthesizer, but then I'd never get to experience the magical rhythm of "Ben's best bent wire," or be able to participate in the shave and a haircut that terminates so many QSOs. There's pleasure in both extremes—feeling the bits between your toes and watching layers of machine intelligence do the work for you. Perhaps the best of both worlds: Decode incoming CW with a computer, log it to RAMdisk, and then regenerate perfectly-timed code (complete with spelling correction) for the brain's arcane pleasure. Hmm...

Anyway, the big issue that always arises in discussions of bicycle-mobile HF is the antenna. For a long time, I believed that mobile whips would be useless at QRP levels, especially with the dubious counterpoise of a bike (albeit a 275-pounder). I thus restricted my operation to campgrounds and backyards where I could uncoil my ropes and dipoles, terrorize neighbors with crescent wrenches slung over trees, and stay up beeping and squawking all night to get a return on my investment. It does work well...with Q-5 reports common, and frequent skepticism about my power levels. But I need to operate while pedaling.

Some time ago, I acquired an armload of Hustler mobile verticals, with super resonators and a folding mast. I gave it a try on 15 meters from somewhere in North Dakota (a QTH that added 10 dB to my 3 watt signal). Surprise...within a minute I had a three-way QSO going with Long Beach and New York. It works! I've started checking into the county-hunter's net bicycle mobile.

Still, there's pleasure in the dipole. I have flung it through a vent window in the peak of an Osceola barn, watched it flap wildly in Dakota winds, and tiptoed through southern gardens to untangle the rope. On the banks of the Yellowstone River, the wrench whistled past my ear and trashed a fender when I used a backing vehicle to get it unstuck from a 40-foot tree crotch. Something about a dipole in the trees seems to echo the spirit of ham radio, whatever that is, and every new QTH in my logbook has a header line that includes a sketch of antenna orientation and some comments about its mounting.

Speaking of the logbook, it is filling rapidly with the echoes of interesting contacts, many flagged with symbols indicating invitations or offers of assistance. Somehow, the essence of ham radio is clearer out here in the QRM and QRN—out here where contacts seem almost conspiratorial and surprises are frequent. In short, there's magic at our fingertips! (Which reminds me: don't forget to use the new CW exclamation mark, didahdahdidahdah, which is short for WOW. See my article in February's *73* for more on this.)

Life As A Roving Guest-Op

One of the most interesting spinoffs of being a full-time nomadic ham, of course, is the frequent experience of meeting other denizens of the airwaves. I'm getting to know all kinds of radios, for in every ham household there's a room full of boxes to investigate.

"Surprise... within a minute I had a three-way QSO going with Long Beach and New York."

I recommend that every ham try this: ask around on the air, swap a few invitations, and start spending a few hours a month at the helms of other peoples' stations. The education is unbelievable. You'll develop standards of comparison for competing rigs. You'll quickly spot differences in performance that can be hard to quantify. And, of course, you'll strenghten friendships, swap equipment and ideas, and learn more than ever about the hobby. Even though I've never had any kind of stable ham shack of any consequence, I frequently find myself in a consulting role—just because I've done time in so many others. I recently spent time with a good friend in Wisconsin whose HF rig didn't "feel" right...it turned out he was running a vertical with no radials.

I'm writing this month's column at the QTH of one of the big guns, KØPP in Deer Lodge County, Montana. Ken is an ARRL Section Manager, as well as the owner of the finest antenna farm I've ever seen (tribander, monobander, Zepp, 160 vertical, OSCAR, various VHF beams, and a forest of 75-foot towers). Driving all this is a TS-940 and a homebrew kilowatt. Ken's a hot CW DXer who can blister along at 30-40 WPM.

But he tuned up the linear, aimed the antenna east, and turned me loose. "Uh, me? A kilowatt?"

He grinned. Tentatively, I CQed. Instant response from the east coast. We chatted awhile, most of it comprised of my marveling at the rig and his marveling at a 40-over signal from Montana. Then, on a whim, I said QRZ after his final...and the roar of tangled voices was a sound I'd heard many times from the opposite perspective.

For four hours I sat in the hot seat, on a roll, buzzing with excitement. With the bike publicity, a killer signal, and a rare county in a rare state, I had a glimpse of how DX stations live. I started feeling guilty over ragchews, knowing that a dozen or so squirming stations were muttering "come on, come on" with every languid comment. I started responding to two or three calls at a time: "New Mexico, go ahead; Tango Yankee, you'll be next." And I twinged a bit when a QRP station in Georgia got over his delight at Montana only to say, "Steve? That doesn't sound like a solar-powered bicycle-mobile rig." Used to being a whisper in the wilderness, I was suddenly the most powerful thing on 20 meters. Strange and wonderful...and a little frightening.

But the best part was watching another few pieces fall into the infinite puzzle—seeing not only a new aspect of the hobby, but also learning about great circle bearings, radiation off the sides of tribanders, the nature of passband tuning, the subjective difference between 100 and 1000 watts, the etiquette of big-gundom, the use of a rotor brake, and countless other little things too small to enumerate but, in aggregate, a major education. And that's what it's all about, and why I recommend that you make a point of learning at a furious pace instead of falling into the tired habits that can make any hobby, along with its practitioner, seem old.

I sometimes forget that learning is the essence of this journey, for it is not so much passion as necessity. Without the stimulus of change and new people, I'd never have found the motivation to so actively pursue new information. Try this: Open doors with HF, pass through them, and explore whatever you find. Make the bandwidth of your participation in this hobby as wide as possible. Visit other stations, and get to know both rig and operator. Push past the same old skeds and contests, for the more interesting we become as a culture, the more we will attract interesting people. There's a critical mass somewhere, and it's becoming increasingly clear that it's not going to be reached through traditional public education.

But we of the networks and airwaves are in a unique position to find it, for we are dispersed across the planet, yet we communicate freely. Think of it as an intellectual responsibility to our species, as well as a whole new level of electronic fun.

Yep, bicycle-mobile HF sure is inspiring. See you somewhere on the air, on the road, or in the vapors of Dataspace! 73

[NOTE: For reprints of earlier articles in this series ($3 for all eight) or a copy of Computing Across America ($9.95 plus $2 for shipping), write to Computing Across America, 1306 Ridgeway Avenue, New Albany, IN 47150.]

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston, TX 77083

AMSAT-OSCAR-13 is providing hams all over the world with satellite activity only dreamed of during the seventies. Its high apogee (point of orbit farthest from the earth) is now drifting northward, revealing the potential for great DX. When the satellite's position is favorable, stations in Europe and Asia can work each other. This should be true of most of the northern hemisphere by 1993.

The maps of groundtracks forecasting future orbital characteristics into the 1990s, that appeared in the September column, need to be modified. When the satellite controllers of AMSAT-DL (West Germany) raised the perigee (point of orbit closest to the earth) to 2545 km, they also affected the date on which the satellite will achieve its most northern apogee. Orbital plots show this to be about five years from now. Causing it to take ten years for the orbit to again have apogee over the equator. The general appearance of the groundtracks as seen in the September column will not change, just the dates associated with the maps.

Simply, The Best

This satellite, A-O-13, is the greatest accomplishment of the amateur satellite program. It achieved the orbit envisioned by its designers over a decade ago and most of the onboard systems perform flawlessly. Some concern still exists with the temperature sensitivity of the RUDAK packet radio experiment and the desense to the Mode L 23-cm uplink band by terrestrial radar, but as many hams have discovered, activity via A-O-13 is fantastic. Weekend activity via Mode B (70 cm up and two meters down) sounds like 20 meters with good band conditions.

In addition to typical one-on-one QSOs, other activities are beginning to appear in the passband. Nets and contests have been announced.

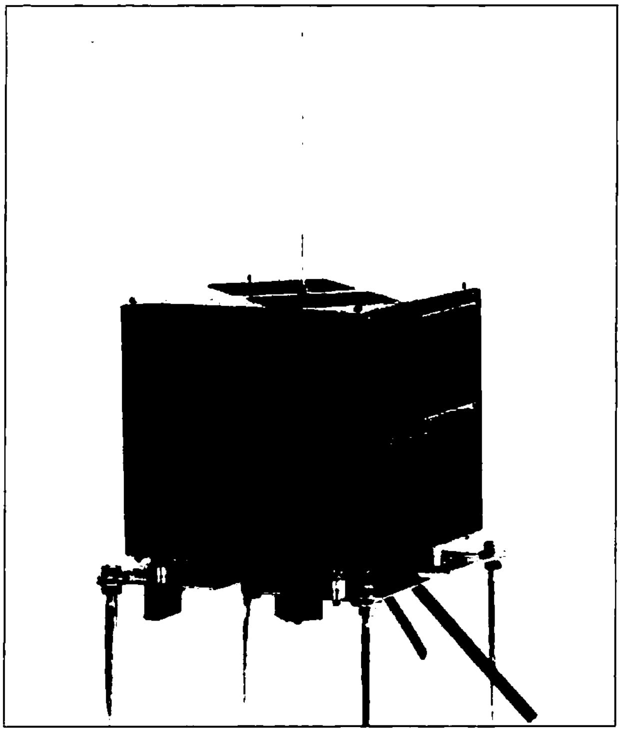
AMSAT nets have been active on Friday nights on both Modes B and L. Since the satellite is not always in a favorable position at the same time every week, these nets aren't easily scheduled. Check the AMSAT bulletins via packet networks, the bulletins on the 75-meter and 20-meter nets, and the *Amateur Satellite Report* for times and frequencies. Those interested should also check into the Space Education Net, held every Saturday. Again, check AMSAT sources for more information.

Contesting

The first contest to be announced for the hamsat community is a continuation of a program started on AMSAT-OSCAR-10 several years ago. It is the K2ZRO Memorial Station Engineering Award program. In this test of operating skill and equipment performance, a control station sends and repeats numeric code groups at different power levels. The satellite operators measure the receive sensitivity of their satellite station for comparison with other participants. Those who can copy the satellite's beacon can get started in this program.

The challenge of this program comes when the satellite enthusiast pursues endorsement stickers for station improvements on both Mode B and L reception. While the first code group is sent at beacon level, the power uplink is dropped by three dB, cut in half for the next. Subsequent levels are sent three dB down from the previous one until a level is sent causing it to be so low in power that the noise floor of the transponder enters into the equation. The ZRO Test, as it is commonly called, is the best opportunity to test system performance. For more information on this activity, send an SASE to me with two units (45 cents) of postage on a #10 (business size) envelope. Be sure to mark your request "ZRO brochure."

Other activities are in the works. The SATFOX hunt will offer a satellite-based foxhunt unlike any other transmitter hunt here on earth. Participants must use Doppler calculations and other measurements to determine the location of a terrestrial transmitter uplinking through the satellite.



AMSAT's new "Microsat" bus. This can carry a variety of sophisticated commercial and scientific payloads using a high-density, highly modularized design. Electronic mail is one of the first applications. At least four AMSAT Microsats will be launched in 1989 by Arianespace with the SPOT-II mission. [Photo by R. Jansson.]

Keep In Touch With The Times

Operating times for satellite activity change seasonally. The orientation of the spacecraft with relation to the earth is constantly modified for optimum sun angle. Unlike A-O-10 which can no longer be controlled due to memory loss, A-O-13's on-board computer is programmed to keep the satellite's solar array aimed at the sun. This causes the aiming of the satellite antennas to change, thus different portions of the orbit yield the best operating times for Modes L and S (70 cm up and 13 cm down), which have highly directional helix antennas. The satellite controllers here and overseas also program the computer to turn on the directional modes, when the satellite's antennas favor the earth. In late September the first schedule changes due to "offpointing" went into effect. Check the nets and *ASR* for updates.

Mucho Dinero

OSCAR 13 was not cheap, straining the financial resources of AMSAT-DL and AMSAT-NA (North America). Both organizations have many new ideas and projects that must wait until adequate funding can offset the huge expense incurred by OSCAR 13. Estimates of A-O-13's value range from $250,000 to $750,000. A commercial or military satellite of the same caliber could cost as much as 10 to 20 million.

That $250,000 estimate doesn't include many expenses due to travel, transport, licensing, insurance, and launch-related costs. It also assumes that surplus equipment from A-O-10's development was used. The transponders in A-O-13 are the flight spares from A-O-10.

Although the ride to space was free, terrestrial transportation of the spacecraft was not. Just sending the satellite across the ocean a few times cost $20,000. Long before launch, A-O-13 had seen several countries on three continents. There were also travel expenses for the specialists involved in satellite construction.

AMSAT received very good rates for insurance. The premium was about 12 percent. AMSAT-DL and AMSAT-NA split the nearly $30,000 cost of covering a nomi-

nal $250,000. For AMSAT-NA this meant taking several thousand dollars from operations funds and the technical research budget. The insurance was necessary, and there was support from the membership, but the one-time lump-sum charge significantly drained the treasury.

Launch-oriented costs included engineering studies, system integration analysis and software development. Special hardware was built to mount the satellite with the other payloads onboard the Ariane 4 launcher. The cost of adding A-O-13 to the mission was about $100,000. There was no charge for the ride, but "there's no such thing as a free launch."

Considering the many hidden costs incurred during the development, construction and launch of A-O-13, a $500,000 estimate of worth seems more appropriate. Many of the drawings and flight spares were on hand at the beginning of the Phase 3C (now A-O-13) project. Phase 3A was built during the late seventies and Phase 3B (now A-O-10) was completed by 1983. To start from scratch with nothing except an idea, add another $250,000. In addition to being the highest repeater around, A-O-13 is also one of the most expensive.

Microsats

All the excitement surrounding A-O-13 sometimes eclipses news about another fascinating sat project—Microsats.

This project will send into space very small (nine inches on a side) special-purpose satellites. Two are to be packet radio systems, one will carry a speech synthesizer and the fourth is a CCD (charge-coupled device) camera experiment.

> *". . . there's no such thing as a free launch."*

Last month's "Hamsats" column reported a launch of the four Microsats in late 1989. The actual date could be as early as January, 1989. AMSAT Director Tom Clark W3IWI reports that a structural model of a Microsat was subjected to flight vibration qualification tests in late August. It passed at 14G with no problems.

The idea for Microsat-style packet-radio satellites first came up in early 1982, just after the first ARRL Networking Conference. This type of satellite would provide non-real-time worldwide communications using digital store-and-forward techniques via low-earth-orbit hamsats. Today Fuji-OSCAR-12 is an example of the type of communication system anticipated for the packet Microsats. Uplink and downlink formats would be nearly identical with Mode J operation using 1200 baud FM up with PSK (Phase Shift Keying) down.

In late 1987 the mechanics of the basic Microsat structure went from the ideas of premier satellite builders Jan King W3GEY and Gordon Hardman KE3D, to a fully-documented set of designs by Dick Jansson WD4FAB. The complete structure uses five 8" square module trays, 1.6" thick, stacked to create the inner satellite frame. A packet Microsat would include modules for receivers, batteries, the CPU (central processing unit) with memory, and a transmitter. The CCD camera experiment could use some of the same parts, but would also include a camera. The individual modules connect to the system via high reliability DB-25 connectors.

In early October, three papers concerning the Microsat Program were presented to the 7th ARRL Networking Conference. Tom Clark's paper gave an overview of the projects' goals. Another by Lyle Johnson WA7GXD and Chuck Green N0ADI described the flight CPU for the satellite. Harold Price NK6K and Bob McGwier N4HY presented the third paper with a description of the multi-tasking software that will be used to control the onboard systems.

For complete details of the inner workings of the Microsat program from AMSAT-NA, get a copy of the conference proceedings published by the ARRL. In just a few months the first group of Microsats could be in orbit. Thanks to design simplicity, many more Microsats could easily be built on short notice for future launch opportunities.

Number 19 on your Feedback Card

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
PO Box 1079
Payson, AZ 85541

November 1988

DX conditions for November are expected to be quite good on all HF bands. The general rule is to listen *to the east of your location* between 10 AM and 2 PM local time on the 10–20 meter bands. As the earth rotates and the sun moves westward, skip conditions gradually move west with the sun. Between 4 PM and 8 PM local time, expect to hear stations *to the west of your location*. On the bands between 10 and 30 meters, look for excellent Pacific DX in the late afternoon and early evening. On the very good days when the magnetic field is quiet and the solar flux is high ("A" factor below 5 and "SF" factor above 135) expect to hear DX stations to the west of your location up until about 10 PM local time.

Early morning hours just before, just after, or at sunrise are the best times to work Pacific Ocean DX on the 30–160 meter bands, while late evening hours are the best for working DX to the east—to Europe and the USSR.

Be particularly aware that excellent signals are often propagated along the so-called gray line at dawn and sunset. There are several useful charts, as well as computer programs and hand calculators/slide rules, available to help you decide where signals are most likely to be heard at these times.

Lower atmospheric noise levels will help you on the 40, 80, and 160 meter bands during November.

DX stations from South and Central America and the Caribbean are best heard on 40–80 meters during the early evening hours. Earlier, in the afternoon, they come on the 10–20 meter bands.

Short skip on the various bands above 40 meters (10, 15, 20, and 30 meters) will prevail during the daylight hours, then increase in distance toward the late afternoon and early evening.

While late fall and early winter DX is not quite as good as spring and fall DX (because of fewer daylight hours), you will still find many good openings and opportunities this month.

Using the charts in conjunction with WWV transmission at 18 minutes after each hour is quite simple: record the Magnetic Field index (A) and the Solar Flux value for the time of day you listen. The values are usually updated every several hours or so.

Look for trends as well as values. Trends are given when WWV reports solar activity (low, moderate, or high) for the last 24 hours and expected values for the next 24 hours. It also reports geomagnetic field activity (quiet, unsettled, active) for the same periods. The best time to operate is when the geomagnetic field is *Quiet* and the Solar Flux is *High*.

In November, only 25–50% of the days will be good DX days. Use the daily calendar to note Good, Fair, or Poor (G,F,P) indications. Do not believe implicitly in the daily forecast, as Mother Nature always has a way of fooling the prognosticators. Historically, our forecasts have proven correct 75–80% of the time. At best, they are guides rather than rules. Remember that geophysical conditions are ever-changing, and that the most fun (and frustration, too) often occur at unexpected times.

NOVEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G	2 F	3 P	4 P	5 P–F
6 F	7 F–G	8 G	9 G–F	10 F–P	11 P–F	12 F–G
13 G	14 G–F	15 F	16 F–P	17 P–F	18 F–G	19 G
20 G	21 G–F	22 F–P	23 P	24 P	25 P–F	26 F
27 G F–G	28 F–G	29 F–G	30 F–G			

73 Review *by Hal Mandel KA1XO*

The Nye-Viking MB-V-A 3000 Watt Antenna Matcher

William M. Nye Co.
1614 130th Ave. NE
Bellevue WA 98005
(206) 454-4524
Price Class: $600

A solid easy-to-use tuner.

A tuner is a tuner is a tuner. Right? Wrong! The transmitter or linear amplifier may be happiest when looking into a 50Ω resistive load, but most real-world antenna systems don't provide this. One ol the big measures of tuner quality is its ability to create an acceptable load from a variety of antenna systems.

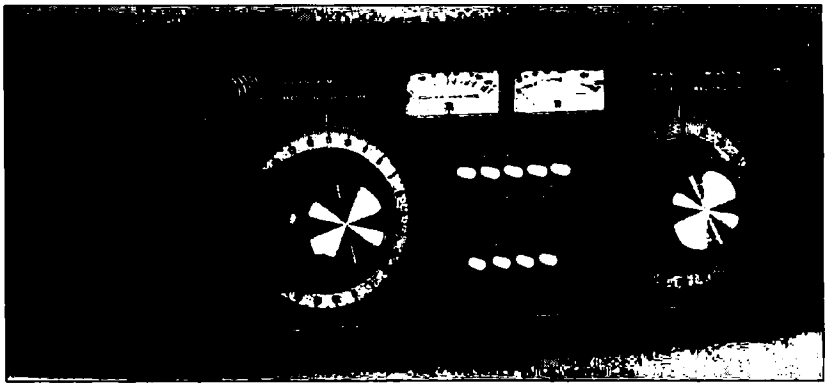
In 1984 I found myself with a six-slinky dipole, three to a side, fed in the center with a 450Ω ladder line. The 4:1 balun handled high power, and the wire loaded up anywhere from 1800 kHz to 29.9 MHz. The biggest problem with RF was on 40 meters. When I loaded up a new amplifier, the next thing heard, seen, and smelled was the RF ammeter frying away in the Maxwell Transmatch.

Considering the replacement of antenna matchers, I debated whether or not to build my own. After perusing blurbs of various flavors of antenna matchers, I took my chances and ordered an MB-V-A. The unit arrived in several days, in superlative packing. It could have been parachuted into New Hampshire without denting the merchandise.

Immediately upon arrival, I removed all the covers to see what the guts were like. Very impressive. I had no trouble believing the claimed rating of 3000 watts.

Six Features of the Nye MB-V-A

The components of the MB-V-A are different from other matchers I've inspected. First, the roller inductor is constructed by using an air-wound form, with the roller situated on the inside of the coil form, hanging on an arm which is rotated at the front end by a gear-driven assembly. This makes the roller turn faster than the hand crank. Whereas other roller inductors I've dealt with developed considerable momentum when spinning, this design is instantly controllable and easy to spin. The gear assembly affords some drag so that it doesn't feel cheesy. The control knob and associated planetary escutcheon on the front panel is calibrated completely around, and is of wide enough resolution to permit easy recognition and subsequent relocation when tuning up on the same frequency. The spinner knob is huge (2¾" in diameter), with an easily operated spin attachment (¾" by ½") on the front—great for guys like me with big hands. The skirt on the knob has a white line for easy resetting by noting where it lands at resonance.



The Nye Viking MB-V-A 3000 Watt Antenna Tuner.

Second, the variable tuning capacitor looks big enough to see service in broadcast equipment! Having experienced the syndrome of not enough plate separation in past days of building (I wondered what was being arc-welded when the RF jumped), I was overjoyed to find that Nye didn't skimp on their capacitors. The diameter of the entire variable, when fully unmeshed, approaches six inches, and is a good seven inches from front to back. The bearings are pre-lubed, and have a good feel when going around. They are driven by the 2-⅛ control knob on the front panel. The panel itself has a good bushing, so there's no side play on the shaft—something that happens with flexible insulated shaft couplings. The escutcheon is calibrated completely around, with two scales going from zero to one hundred in opposite directions. This enables the user to register and duplicate settings on both rotational segments of the variable capacitor. The black phenolic control knob has a white line on the skirt, immediately above the zero escutcheon dial registration, for easy placement of the dial's position when hunting for a number in a hurry.

Third, the tuner affords four values of fixed capacitance, above that offered by the variable itself, that may be switched in or out. As the manual states, there are "five different amounts of parallel capacity" available for the operator's use. The sections of fixed, high-voltage capacitors provide 160 picofarads each, and are switched by an interlocking arrangement controlled by four pushbuttons in the middle of the lower panel. This pushbutton system is extremely hefty, and from the looks and feel of it, will provide years of trouble-free service. The sections of fixed capacitance are shunted in and out of the tuning circuit by this mechanism, and the switch contacts themselves are silver-plated and spring-loaded.

Although the Nye Company expressly advises against hot-switching these capacitances in and out, I feel they are covering their equipment's protracted serviceability, especially for the types out there who would switch stuff in the RF output line at full power. Maybe five or so watts would be no problem, or even 500 by the looks of the switch gear, but I'll accept their recommendation anyway, and shut down when I fool with the buttons.

Fourth, the antenna switching arrangements found on the front panel are marvelous for tuning up. The five buttons are arranged as A direct, 2nd A, B, C, and D through the MB-V-A. The corresponding connectors on the rear apron are denoted A, B, C, and D. This feature allows the operator to access a dummy load by just pressing a front panel control, which bypasses the internal circuitry of the tuner. So tune up the exciter and linear, and then switch in the antenna system to a radio that's looking for a 50Ω non-reactive load. And do it with one button. That's great. The switches connect to the rear apron in the following manner:

"A" is direct through, and appears on a UHF-type SO-239 panel connector.

"A, MB-V-A" uses the tuner circuit in the above rear apron connection.

"B" through the tuner circuitry, appears on another UHF-type SO-239 panel connector.

"C" through the tuner circuitry, appears on a ceramic feedthrough insulator, and is the long-wire antenna connection.

"D" through the tuner circuitry, and through a 4:1 ferrite form balun transformer inside the tuner, appears as a pair of wire connectors on ceramic feedthrough insulators. This is the balanced line antenna connection.

Nye states the matcher will handle more than 3000 watts into loads between 40 and 2000Ω impedance, with an SWR of less than 1.1:1. They do, however, qualify the trifilar-wound balun as capable of matching balanced lines only between 200 and 1000Ω and unbalanced coaxial-line loads down to 20Ω. The Nye company specifies that the tuner is good from 160 to 10 meters. It is 36.8 centimeters wide (14.5"), 17 centimeters high (6.7"), 35 centimeters deep (12.25"), and weighs 6 kilograms (14 pounds). The manufacturer warrants these units for two years.

The switching gear in the antenna selection apparatus is likewise of good quality construction, with silver-plated contacts on spring-loaded armatures. This affords greater reliability. Once again, the operating manual warns against hot-switching the antenna buttons, prematurely fatiguing the contacts. The way this matcher is built, I'd lay odds on my rig frying before the matcher does.

Needless to say, the overall impression of the mechanical construction of the tuner is favorable, and is reminiscent of how equipment used to be built.

Dual Wattmeter

This is also known as the Forward and Reflected Power Meters. The tuner meter circuitry is operated by a self-contained nine volt transistor battery, with meter backlighting available with the application of 12 volts at 0.12 amperes to a rear-apron RCA connector. There's a front panel switch on the upper right corner for turning the lamps on and off. The meters display the level of power the system is generating and the antenna is reflecting. It's helpful to tune the matcher for the lowest reflected power settings on the meters. There's an LED below the meter which lights up when the meter-sensing circuitry shifts gears and displays on the 3000 watt scale. Normally, the meters display on the 300 watt scale. The circuitry resets to the lower power setting after five seconds of lower power, or no power, and this is one area in which I've encountered difficulty.

A Few Niggling Points

When tuning up the amplifier chain, the power meter jumps back and forth between scales, and though I try to keep the power level uniformly low, I encounter this bobbling between scales at the most inopportune moments. This is frustrating, as not only am I looking at the two meters on the matcher, but at other meters elsewhere at the same time. Rapid swings of the meters is cause for heavy breathing. Nye just released a stand-alone version of this wattmeter with controls to hold it in one scale or the other, and I hope this feature will be incorporated into the MB-V-A.

The only other difficulty with this unit was some scratchy noises in my receiver as I rotated the inductor knob. I lived with it for a while, then I took the unit apart, and cleaned the sliding and rolling contacts with chloroform to remove any contaminants, but to no avail.

KA1LAO was visiting one evening and he heard the noises. We yakked about it for a while and he thought of using powdered graphite on the roller inductor parts. I just happened to have a tube of "Mr. Zip" around, so we took the tuner apart and sprayed graphite powder onto all those parts that touch one another. Lo and behold, the scratches disappeared, thanks to Jim and Mr. Zip.

Finally, the instruction manual has helpful suggestions on antennas, gives diagrams of what's inside the matcher (although some of the schematic symbols are from the "1914 Guide to Wireless Telegraphy"), and details operational procedures well. There's a chart page on the inside rear leaf where the operator may log 21 Frequency/Inductance/Capacitance settings for four antennas, labeled "A, B, C, and D."

My overall impression of this piece of equipment was very good. I heartily recommend it for the amateur who wishes a tuner capable of handling high power levels, long duty cycles, and large mismatches. This machine will withstand high RF circulating currents, high voltages, and high temperatures. The components are good quality, and all in all, the MB-V-A 3000 Watt Antenna Matcher makes a worthwhile addition to any hamshack.

Number 21 on your Feedback card

73 Review *by Arliss N. Thompson W7XU*

Orion Hi-Tech 146 MHz Half Wave HT Antenna

Go from scratchy to full quieting signals with a switch to the whip.

Orion Hi-Tech
PO Box 8771
Calabasas, CA 91302
PH: (818) 888-4927
(800) 255-7020
Price Class: $20

Most of us soon tire of a rubber duck's marginal performance. Too often we are unable to work through a favorite repeater from certain locations in the neighborhood. Also, it's nice to more frequently be able carry on conversations in the low power mode rather than in the battery draining high power position. If so, then Orion Hi-Tech may have the solution to your problems.

The Orion 146 MHz half wave antenna is specifically designed for handie talkies. Finished in shiny chrome and equipped with a standard BNC connector to attach to your HT, this telescoping antenna measures nearly 42¾" long when fully extended. When collapsed for storage, its length is a more manageable 8½". For comparison, the rubber duckie that came on my Kenwood TR-2500 is just over 7" in length. No doubt about it, the Orion is a large antenna when mounted on a handie talkie, making it essentially a rigid antenna.

With the Orion's big size comes big performance. I did not attempt to measure the gain of this antenna. An HT half wave antenna design, however, generally has about 6 dB gain over a standard rubber duckie. Signals that were marginal to unreadable became easy copy when I replaced my stock HT antenna with the fully extended Orion. With the Orion in place, I was able to work stations who otherwise found my signal to be too "scratchy" when using the rubber duckie.

What are the drawbacks? The large size is an obvious factor. The antenna collapses to a size that is slightly longer than a standard rubber duckie, but it is not functional in that configuration. It is also rigid rather than flexible. The Orion half wave is no different from similar antennas offered by other manufacturers in this regard. The connector and the antenna are essentially one piece. Orion Hi-Tech may want to consider using a double spring BNC connector on the antenna for added flex. Exercise care when using any antenna of this size when mounted on an HT.

The Orion Hi-Tech half wave antenna is specified to handle 10 watts with a 10 MHz bandwidth, which should be more than adequate for all 2 meter HTs. It carries a 90 day guarantee. In addition to this half wave HT model, Orion Hi-Tech manufacturers a full line of other antennas.

NEW PRODUCTS

Compiled by Linda Reneau

PRODUCT OF THE MONTH

UNIDEN CORPORATION OF AMERICA

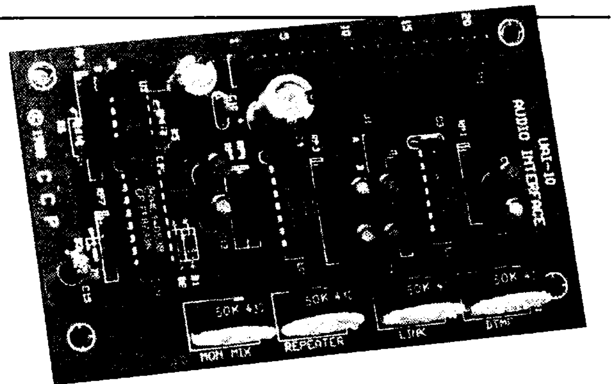
Uniden's President HR-2510 Mobile 10 Meter Transceiver covers the 10 meter band from 28 to 29.7 MHz. You can operate on CW, AM, FM, and both sidebands, and choose steps of 10 or 1 kHz, or 100 Hz. Other features include preprogrammed 10 kHz channels, backlit LCD display, receive scanning capability, microphone with channel up/down select, frequency lock, auto squelch, noise blanker, RIT, and RF gain control. Ports to hook up key and external speaker. You can check your transmit power, received signal strength, modulation, SWR calibration, and SWR with the multi-function LCD meter. Suggested list price through distributors is $400. For more information, contact *Uniden Corporation of America, 4700 Amon Carter Blvd., Ft. Worth TX 76155; 817-858-3300.* Circle Reader Service number 201.

ACE COMMUNICATIONS

Ace Communications, a subsidiary of AOR, Ltd. of Tokyo, announces a 100 channel hand-held receiver that offers complete public service band coverage. It is 5¾" x 2⅛" x 1¾" and weighs 12 ounces. Frequency coverage is 27–54 MHz, 108–174 MHz, 406–512 MHz, and 830–950 MHz. This covers all police, fire, and emergency bands, plus the new services above 800 MHz. Frequency stepping increments are 12.5, 25, and 30 kHz.

The AR-900 has twenty-five front panel keys, five banks of twenty programmable channels each, pairs of upper and lower limits for program scan, and five search memory locations. All information is stored in three permanent memories that retain their contents even after the batteries are disconnected. Antenna connects via a BNC connector.

Extra features include first channel priority, keyboard lockout, and a blue-green display backlight for night use. The LCD display offers 22 prompting annunciators. Price is $299. For more information, contact *ACE Communications, Monitor Division, 10707 East 106th Street, Indianapolis IN 46256; 317-842-7115. FAX 317-849-8794.* Circle Reader Service number 202.

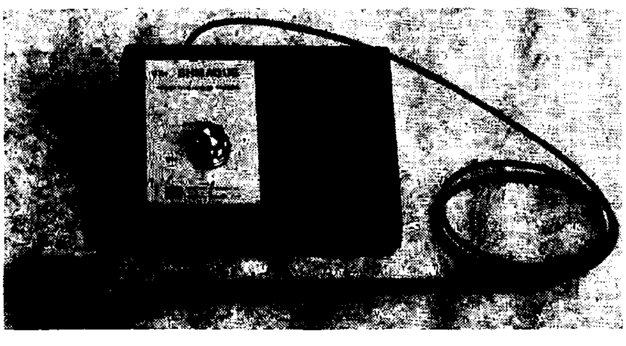


CREATIVE CONTROL PRODUCTS

The UAI-10 Universal Repeater/Link Audio Interface board from Creative Control Products features DTMF Mute and link Monitor-Mix adjustable control. Audio inputs consist of repeater, link, control receiver, CW/Tone, and an auxiliary input for other audio sources. Audio outputs consist of repeater, link, and DTMF output for the DTMF decoder.

Control inputs to the UAI-10 consist of +8–15 VDC, repeater COS (high or low selectable), DTMF mute, and auxiliary output from your controller for the link mute function.

A jumper comes with the UAI-10 to enable you to mute or pass DTMF tones out the link transmit audio. Introductory price, $44. *Creative Control Products, 3185 Bunting Ave., Grand Junction CO 81504; 303-434-9405.* Circle Reader Service number 204.



ELECTRON PROCESSING, INC.

The SHMAGUE, new from Electron Processing, Inc., is a sensitive audio signal tracer that picks up a current's magnetic field. By holding the SHMAGUE's wand near an object, you can listen to these signals without electrically or physically contacting them. Besides tracing audio signals on PC boards, you can safely identify AC power lines.

The SHMAGUE comes in a 5.3" x 4" x 1.5" housing. The magnetic wand is connected via a six-foot cable. Powered by a nine volt battery, and complete with internal speaker and volume control, the SHMAGUE is portable. A phono jack is provided for your scope or counter. Pricing starts at $60 with quantity discounts. *Electron Processing, Inc., PO Box 708, Medford NY 11763. Sales Department, 516-764-9798.* Circle Reader Service number 203.

INTERNATIONAL RADIO INC.

International Radio Inc. announces the IRI Tuning Upgrader which comes in three models for the TS-440, the TS-940, and the TS-930. The Tuning Upgrader lets you fine-tune incoming stations with ease, yet also move across the bands in seconds. Uses low-power CMOS circuitry. Has a speed indicator LED. Comes with clear instructions for installation.

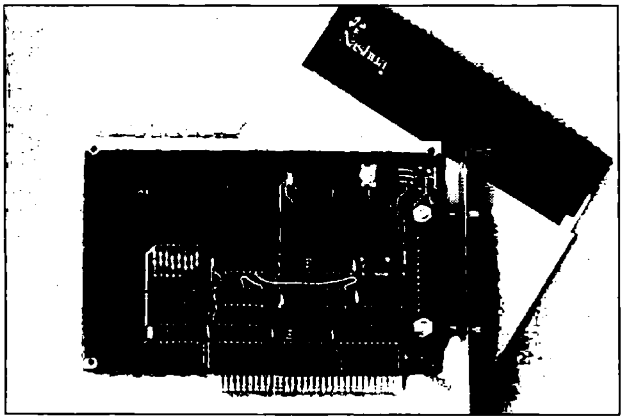
Correctly installed, the IRI Tuning Upgrader will not void your Kenwood warranty. If you do not wish to do the installation yourself, International Radio can do it for $22.50 plus shipping. Each model is $34.95 plus $5 postage. Specify TU-440-541, TU-940-539, TU-930-540. *International Radio Inc., 751 South Macedo Blvd., Port St. Lucie FL 34983; 407-879-6868.* Circle Reader Service number 213.

ELECTRONIC SPECIALISTS, INC.

From Electronic Specialists, Inc., come the "Pocket Protectors" for portable computer protection. The AC Power Pocket Protector (LTP-101) combines filtering and spike/surge protection at 39,000 surge amp suppression.

The Modem Pocket Protector (LTP-201) combines multi-element spike suppression with RF filtering and balun noise filtering.

Each unit fits neatly inside a pocket. Price of the LTP-101 is $65, and the LTP-201 is $46. *Electronic Specialists, Inc., 171 South Main Street, Natick MA 01760; 800-225-4876 or 617-655-1532.* Circle Reader Service number 207.



L.L. GRACE COMMUNICATIONS PRODUCTS

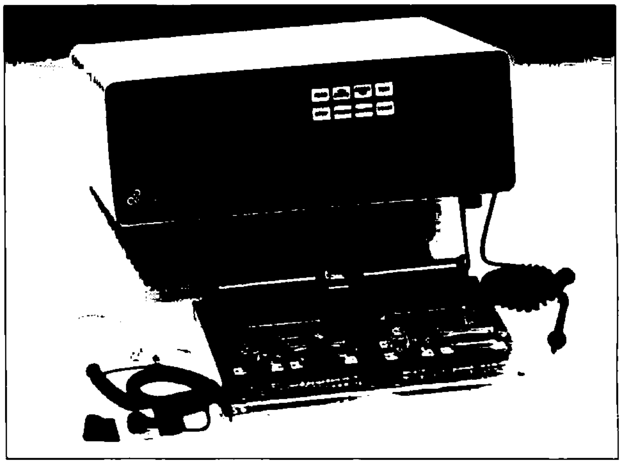
The Kansas City Tracker, from L.L. Grace Communications Products, is an interface card and software package that plugs into the I/O bus of an IBM or compatible, and connects to your elevation-azimuth or azimuth-only rotor control box. It can control the Yaesu/Kenpro 5400A/B and 5600A/B Az-El rotors, or it can connect to other rotor controllers with the Rotor Interface option.

The Kansas City Tuner compensates for a satellite's Doppler shift. It can interface to ICOM, Kenwood, or Yaesu radios through the serial port or mike-click inputs. The KC Tuner can tune both links simultaneously.

The KC Tracker and Tuner can accept orbital positioning information from either GrafTrak or QuikTrak. Software is Terminate-And-Stay-Resident (you can run other programs while your antennas and radios are controlled), and includes programs for automating PBBS antenna aiming to a user-defined azimuth and time. Vision-impaired users will appreciate the built-in Morse code sender that can announce rotor positions and satellite-pass status. *L.L. Grace Communications Products, 41 Acadia, Voorhees NJ 08043; 609-751-1018. CompuServe 72677,1107.* Circle Reader Service number 210.

G AND G ELECTRONICS OF MARYLAND

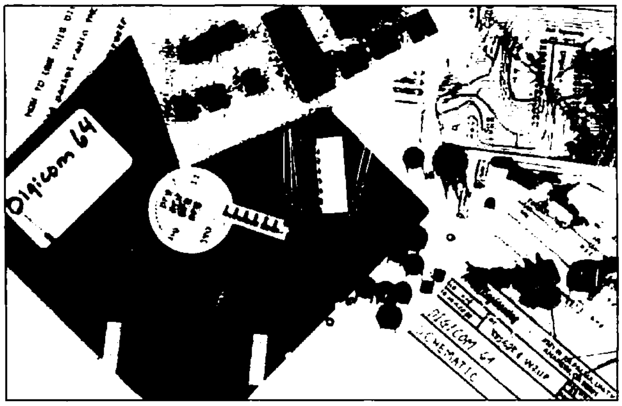
Various products formerly manufactured by Microlog are now available from G and G Electronics of Maryland. The ART-1, AIR-1, and AIR-1 software are among these products. The SWL allows you to copy worldwide shortwave radio signals on your C-64/128. The SWL alone is $64. The AIR-DOS disk, which allows you to to save data, is $15. The MORSE COACH is $49.95. Package price is $99.95. *G and G Electronics of Maryland, 8524 Dakota Drive, Gaithersburg MD 20877; 301-258-7373.* Circle Reader Service number 216.



AMERICAN RELIANCE INC.

The AR-6400P Automatic Cable Tester from American Reliance, Inc., tests cables and wire assemblies of up to 128 test points, and it is expandable to a total test capability of 512 test points by the addition of plug-in I/O boards. It has a built-in parallel printer port, cable included, so that it can print test results and lists of wire. The AR-6400P sells for $995.

The 6401FX Universal Test Fixture is available as an option for $100. Connectors on the fixture include two each of 9, 15, 25, and 36 pin "D" types, and 37 and 50 pin Centronics types. *American Reliance Inc., 9241 E. Valley Blvd., Rosemead CA 91770; 818-287-8400.* Circle Reader Service number 209.



A & A ENGINEERING

Now among the many electronics kits and assemblies A & A Engineering has to offer, is the Digicom>64 by Barry N. Kutner, M.D., W2UP (see his article in the August 1988 issue of *73*). The Digicom>64 is a software-based packet radio system for the Commodore 64 which emulates the functions of a TNC. The PCB only is $10.65; the PCB and disk, $14.95; the kit with PCB and disk, $49.95; assembled board, $79.95; and disk only, $6. *A & A Engineering, 2521 W. La Palma, Unit K, Anaheim CA 92801; 714-952-2114. Stas J. Andrzejewski W6UCM, President.* Circle Reader Service number 215.

Number 23 on your Feedback card

TECH TIPS

Non-Liquid Fix for the C-64 Stutter

With all respect to Bill Clarke WA4BLC, I believe I have improved, on his suggestion, about the best way to fix the Commodore 64 with a stutter problem.

As Clarke mentioned in his article (*73 Magazine*, July 1986), the C-64 has become a fixture around the ham shack. It serves such important purposes as word processing, logging, QSL design, and RTTY communications. Such a hardworking, useful instrument is bound to experience the occasional service problem, and one of the most common is the missed or repeated character.

The problem is the contacts under the keyboard develop a nonconductive coating that causes the stutter malady. The results take different forms, but they are usually aggravatingly apparent in embarrassing typographical errors on RTTY, or frequent use of the delete key in word processing.

"Remember the Golden Rule—keep water away from electrical circuits."

To remedy the situation, Clarke suggests the use of a mildly abrasive bathtub cleaner. Remembering my electrical basics, it goes against my grain to coat a circuit board with a liquid solution that is also an excellent conductor. Remember the Golden Rule of keeping water in all forms away from electrical circuits? So when I developed a similar problem with my C-64, I started looking for an alternative fix.

I followed Clarke's instructions about removing the three screws on the bottom, disconnecting the plugs and wires to the keyboard, and unscrewing the 23 tiny screws that hold the keyboard together. Carefully lifting the circuit board, I turned it over to reveal the green side with the contact points that require cleaning to fix the problem.

Here is where Clarke and I differ. Rather than taking a wet approach, my fix involves using a very dry pencil eraser in the same way used to remove pencil marks from paper. I recommend a Pentel Clic Eraser, which is a white, pencil-shaped eraser in a plastic holder. It is easily found at most office supply outlets. The eraser works so well on *pencil mistakes* (like they were never there), that I suspected it would clean the circuit board quite well, too. Guess what? It does the job perfectly, quickly and keeps the board away from the kitchen sink and possible short circuits.

By rubbing the eraser over the shiny contacts on the circuit board, and after the keyboard is reassembled, it will work as good as new.

So enjoy using the C-64 in all of its many versatile applications in the ham shack. And if and when the keyboard develops the stutter problem, feel confident that the user knows what caused it and how to fix it. Also remember that this has probably saved the user $30 to $100, for the technician repair cost, each time it is performed.

Dust remover spray (available at Radio Shack) and the Pentel Clic Eraser make a great team when it comes to cleaning the Commodore 64 computer. Use the spray to remove the inevitable accumulation inside the 64, and use the eraser to clean the contacts on the keyboard circuit board as directed in the accompanying article.

ERRATA

Welcome Newcomers

Refer to the October 1988 issue, page 4. Look in the "Glossary" for the definition of *frequency*. Frequency is measured in *cycles per second*. One cycle per second is called one Hertz (Hz). Frequency is *not* "given in meters per second, commonly termed Hertz."

Also, refer to the definition of the *electromagnetic wave spectrum* on the same page and in the same section of the October issue. The last line should read that the microwave portion of the spectrum is typically set at "...1,000–300,000 *million* cycles/second." The word "million" was left out—which makes quite a difference!

Antenna Systems—September 1988

A minor typographical error in this article by John Lawson W3ZC, on page 11 pp10, operator j is incorrectly identified as the "square root" of 1, and, unfortunately, appears quite often in engineering." The square root of 1 is obviously still 1. Operator j is actually the square root of MINUS 1, and as it is physically impossible to quantize a square root as a negative number, it is properly referred to as an "imaginary number".

Hams Around the World

Chod Harris VP2ML
PO Box Box 4881
Santa Rosa CA 95402

DXing on 160 Meters

Contacts that are routine on 15 or 20 meters can range from difficult to impossible on Top Band. Yet despite the obstacles (or perhaps because of them), hundreds of DXers have worked more than 100 countries on the band, enough to qualify them for the first single-band DXCC award: 160-meter DXCC.

Antennas For 160 Meter DXing

Far more than on other bands, the antenna for 160 meters can make or break a DX contact. Unfortunately, the simplest antennas to put up are the least effective for 160-meter DXing. Specifically, tying the feeders of an 80-meter antenna together and operating through a tuner will produce an antenna that emphasizes local, rather than DX contacts. Similarly, a low dipole or inverted-Vee makes a poor DX antenna on Top Band. An antenna design that works fine on higher bands is often a marginal performer on Top Band, because a horizontal antenna should be at least one wavelength in the air for the best DX. On Top Band, that's more than 500 feet high!

The beginning 160-meter DXer can make contacts with a loop, inverted-Vee, or half-wave sloper, especially if the apex of the antenna is 80 feet or more in the air. Hanging a full-wave loop off the tower is one of the simplest approaches to a 160-meter DX antenna.

If the DXer already has a tower or other tall support, however, an inverted-Ell or Tee antenna is much more effective than low loops. Construction of an inverted-Ell is simple: run a wire from the ground to near the top of the tower, and then out horizontally as far as necessary to resonate on 160. The longer the vertical portion of the antenna, the better it will work for DX. With two high supports (such as suitably spaced trees), a Tee antenna is often very effective. In either case, a simple tuning network can lower the input impedance of the antenna to near 50 ohms. Both antennas require good-to-excellent ground systems to work well, a factor often overlooked by DXers.

By far the best antenna for 160-meter DXing is a vertical with a good ground. Since few amateurs can erect a 130-foot, quarter-wave vertical, some type of shortened antenna is the norm. Shunt-feeding an existing tower, or loading short verticals are typical approaches to DX-transmitting antennas, especially if operated against a good ground system. The enterprising Kansas City (MO) DX Club once used helium balloons to support their 128-foot vertical!

What constitutes a good ground? A salt-water marsh, 132 ¼-wave radials, or a copper plate 250 feet in diameter, work well. The 160-meter DXer will more likely put down as many radials, as long as possible, and hope for the best. One top-bander has buried old washing machines, refrigerators, and more than 5 miles of elevator cable under his vertical!

Receiving Antennas and Noise

Unfortunately, the best antennas for transmitting on 160 meters are among the worst for receiving. Vertical antennas concentrate much of their radiation in low angles for best DX, but they are also very susceptible to noise. QRN is often the limiting factor in top-band DXing, so most 160-meter DXers erect separate antennas for receiving.

The best antennas for receiving DX on 160 meters are terrible antennas for transmitting: beverages and small loops. Either of these antennas will be as much as 50–60 dB worse than a dipole, so they are useless as transmitting antennas. The good news is that they receive noise even worse than they receive DX signals, so they produce a higher signal-to-noise ratio than other antennas.

For DXers with access to lots of real estate, the beverage antenna works very well. Active Top Bander WB9HAD runs three 1000-foot wires out over his farm after harvest every fall, and rolls them up in the spring before planting season. The beverage can be as simple as a long wire stretched out in the desired direction. Terminating the beverage with a resistor to ground at the far end will make the antenna unidirectional, but most DXers omit the terminating resistor, and live with the bidirectional characteristics of the beverage. The beverage will work even if it must bend around houses, is stuck in a gutter, or run along fence posts. The important thing is total length (at least a few hundred feet), and some sort of matching and amplification system at the receiver end.

> ***"By far the best antenna for 160-meter DXing is a vertical with a good ground."***

To get maximum performance from a beverage, the Top Band DXer should make a small 9:1 impedance matching transformer out of a ferrite ring, and use a preamplifier to boost the very weak signal levels. The DXer must also make some arrangement that prevents accidental transmission into the receiving antenna, or be prepared to buy a lot of replacement preamps. Using the separate receiving antenna jack on the rig (or modifying the rig for such a jack) is the best bet. If the DXer takes the simple approach of installing a separate switch to change antennas between transmit and receive, he will transmit into the wrong antenna while calling some rare DX, with disastrous results.

Space-restricted DXers can resort to a small loop antenna. By rotating the loop, the DXer can reduce much of the noise that would otherwise mask weak DX signals. Hint: try tilting the loop, as well as rotating it, for minimum noise. As with the beverage, some means of impedance matching, preamplification, and receive/transmit antenna selection are essential for best performance.

Finding and Working DX

One of the frustrating aspects of 160-meter DXing is that not all countries allocate the band to amateurs. With Loran-C use declining in the US, stateside hams have access to more of the band, and fewer power restrictions, but other countries still use the frequency range for radio location, and discourage or prohibit amateur use of the band. Among the countries with no 160-meter amateur operation are Lebanon, Liberia, and Morocco. Up-to-date allocation data is available free from IARU Headquarters (c/o ARRL), or for $4 from N7CKD.

Because many countries restrict Top Band amateurs, much DXing is done with wide splits. The DX stations transmit in the 1825–30 kHz range, and listen near the bottom of the band: 1800-1810 kHz. This split is too wide for most RIT controls, so the 160-meter DXer needs a second VFO or other means for using wide splits. Unfortunately, many local rag-chewers hover around this "DX window," often covering up the DX stations.

Some Asian countries (notably Japan) restrict their amateurs to a narrow "window" high in the band, typically 1907–1912 kHz. Again, these stations listen for contacts near the bottom of the band.

During the daytime, high absorption levels limit 160-meter contacts to a few hundred miles at best. Serious DXing on Top Band is a nighttime activity, with DXing often improving as the night wears on and man-made noise sources are turned off. Even at night, absorption limits DX, especially over the noisy polar path. The best times for 160-meter DXing are the long nights in the middle of the winter, when the absorption is extremely low. The bottom of the sunspot cycle provides the best DX opportunities, thanks to lower absorption.

Gray-line propagation provides a big boost to weak 160-meter signals. The Top Band DXer looks for DX to the east at his local sunset, and to the west at local sunrise. He also has access to sunrise/sunset times for other countries. The best time to work European DX is sunrise in Europe, for example.

Many active Top Band DXers spend much of their operating time on higher bands, especially 20 meters, talking to DX stations about getting on 160 meters, and arranging schedules. "When are you going to be on 160?" is a frequent question directed at DXpeditioners, for example.

DXing on Top Band is a challenge, and the casual operator will soon tire of the static crashes, incessant noise, the local rag-chewers transmitting on top of rare DX, and the late hours. But for the dedicated DXer, 160 meters offers many rewards and satisfactions. Try it this winter!

AERIAL VIEW

Antenna News

Arliss N. Thompson W7XU
RR 3, Box 224
Sioux Falls, SD 57106

Going Horizontal

When someone talks of going mobile with their VHF or UHF rig, what does that bring to mind? For many hams it implies FM and repeaters, with a ¼- or ⅝-wave vertical antenna secured to their vehicle's roof with a mag mount. To them, 2 meters is synonymous with FM. Though repeater operation may be fun, there is more to the world of mobile operation at VHF and above than autopatches and squelch tails. What I am referring to, of course, is SSB (and even CW!).

If you never tried working SSB on 2m while mobile, you may be wondering why anyone in their right mind would forsake the vast network of repeaters that exists in this country, and attempt to work other stations directly. One reason is that, under weak signal conditions, sideband has a considerable signal-to-noise ratio advantage over FM. With enhanced conditions, the folks on FM may be commenting that the signal from the repeater seems just a bit stronger today, while a couple of MHz away SSB operators may be working stations several states distant. Sound like fun? It is!

A Catch

If you want to try operating from a mobile on VHF SSB, be aware that it may not be quite as simple as flipping a switch from FM to USB on the multimode transceiver. While FM repeater operation is universally vertically polarized, most base stations on the narrow-bandwidth modes use horizontal polarization. Simply going from FM to SSB without changing the antenna results in a significant loss of signal due to cross-polarization, often 20 dB. You can still work stations on the vertical antenna, but a horizontally polarized antenna gives you a markedly greater operating range. While not as familiar to most amateurs as a vertical ⅝-wave mag mount, there are

> *"20-dB is a lot of signal strength to give up."*

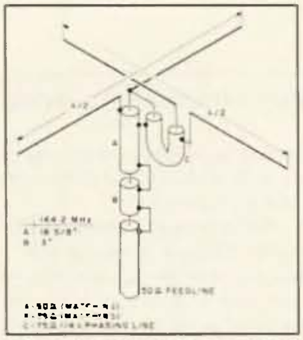


Figure 1. The turnstile, or crossed dipole, antenna.

several types of antennas that are relatively omni-directional, and yet are horizontally polarized. These antennas are adaptable for mobile use, are easy to build, and can be designed for any of our VHF/UHF bands. Thismonth's column focusses on four examples of such antennas.

"X" Marks The Spot

A schematic diagram of the turnstile antenna appears in Figure 1. This antenna consists of two dipoles mounted at right angles to each other and fed 90 degrees out of phase. Placing a quarter-wavelength of feedline between the feedpoints of the two antennas effects the phase shift. Remember to take into account the velocity factor of the coax used for the phasing section when computing coax length.

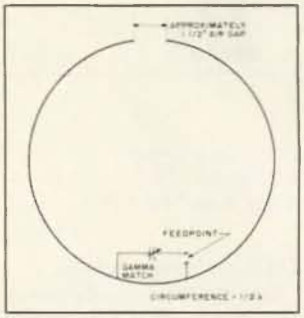


Figure 2. The halo antenna. The radiator can be fashioned from ¼" aluminum rod or copper tubing. For the 2 meter band, its length would be 38⅛".

The matching section shown in Figure 1 was designed for the 2 meter band using the short BASIC program that appeared here in the August 1988 issue. Most versions of the turnstile use a 75Ω phasing section, a 50Ω quarter-wave transformer, and a 75Ω feedline. The use of a series-section transformer allows the use of a 50Ω feedline, as shown. Photo A shows a completed turnstile. Since a car's roof looks like a large reflector at VHF, an turnstile mounted too close to the vehicle will have most of its signal directed vertically upward, rather than toward the horizon. When possible, place this antenna (and the others described here), at least ½-wavelength above those reflective surfaces.

Heavenly Alternative

Another common VHF/UHF SSB mobile setup is the halo antenna. It appears in Figure 2. The halo is basically a half-wave dipole that is bent to form a circle (or, as shown in Photo B, a square). It is frequently fed via a gamma match. The version I built for the 2 meter band (Photo C) used a ¼" diameter gamma rod 5" long, spaced ¾" from the ¼" diameter radiator. The match's capacitor was approximateley 20 pF. The dimensions of the matching device, and the value of the series capacitor necessary to obtain a 1:1 match, will vary with the antenna's height above ground. The above numbers

Photos A–D. Horizontal mobile antennas for VHF/UHF.

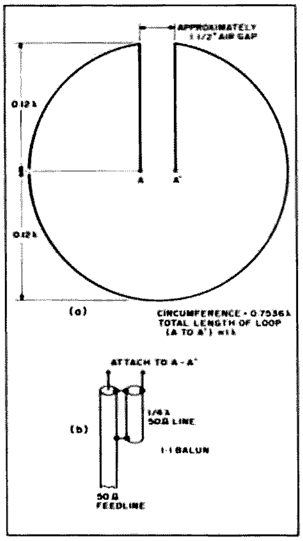


Figure 3. The lambda loop antenna (a), with 1:1 coaxial balun details (b).

should provide a starting place for those who wish to duplicate this antenna.

Two stacked halos increase gain and lower the angle of radiation. A typical spacing distance is ½-wavelength. To achieve a proper match, first

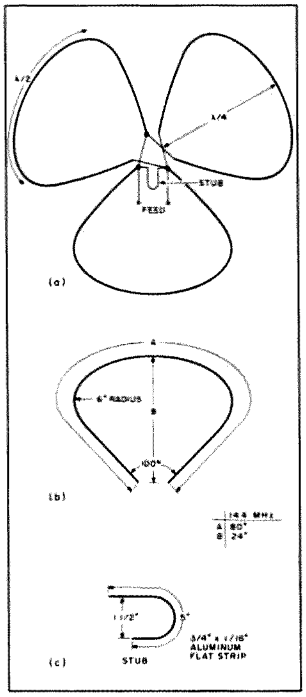


Figure 4. The big wheel antenna (a), with detail of one of the elements (b) and the matching stub (c). Dimensions shown are for the 2m band, but they can be scaled for operation on other frequencies.

match each antenna to the main feedline (assumed to be 50Ω). This lets you feed each antenna via a quarter-wavelength of 75Ω coax. The two lengths of 75Ω line are joined with a "T" to the 50Ω main transmission line.

Lambda Loop

The lambda loop is similar to the halo in that both are dipoles formed into loops. The lambda loop, however, is one-wavelength in circumference, which gives it some gain over a halo. See Figure 3 for the loop schematic. Feedpoint impedance is reportedly about 50Ω (RSGB VHF/UHF Manual), making coaxial feed via a 1:1 balun convenient.

The Big Wheel

This antenna is certainly an attention-getter. W1FVY and W1IJD developed the big wheel years ago. Its name aptly describes it—it consists of 3 one-wavelength elements bent in the manner noted in Figure 4 and connected in parallel. The result, effectively, is that the center portion of each element is a ½-wavelength radiator with a ¼-wavelength feeder. The three elements together are thus three ½-wavelength radiators in phase.

Having a hard time visualizing the antenna despite the schematic? See Photo D to help you. Gain over a halo is 2 to 3 dB, roughly equivalent to stacking two halos. Note the construction details in Figure 4.

"It's easy to get in on the fun of mobile VHF SSB."

For More Info

This month's column should provide you with some ideas on how to make your own horizontally-polarized mobile antenna for the VHF/UHF bands. Given the relatively small dimensions involved and low cost of materials, there's little reason not to try building one of these beauties yourself. For more information on these types of antennas, refer to some of the older editions of the *ARRL Antenna Book* or *VHF Manual*, or the *RSGB VHF/UHF Manual*. Good luck, and see you on SSB!

Number 26 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free, on a space-available basis. To make our job easier and to insure your listing is correct, please type or print your request clearly on a full (8 ½ x 11) sheet of paper. Double-space and use upper and lower case letters where appropriate. Also, write numbers carefully—a 1, for example, can be read as an l or an i or a 7 as a 1. Thanks for your cooperation.

Wanted: External Frequency Display YC-7B for the Yaesu FT7B.

Bill Parker W4YKW
3154 Ravenwood Dr.
Falls Church VA 22044

I need service info for the following items and will purchase or pay for the copying costs: Unicom Electronics power supply Model PS-11R, Tandy 64K Color Computer II, Model 26-3127, EMP/GTS Manual Mini Modem Model MM-101 (manufactured by Elec and Eltec Co., Hong Kong), Heathkit Oscilloscope Calibrator Model IG-4505, Leader RF signal generator Model LSG-11, Garrard Turntable Model Lab 95B, Johnson Messenger CB Model 323, Apple IIe Pro System Duo-Disk Imagewriter Printer/Monitor II, and ICOM IC-735 transceiver.

Mike Adams
Haney Vo-Tech Center
3016 Hwy 77
Panama City FL 32405

I am looking for a receiver for the 225-400 MHz AM Military aeronautical band. I know that there are several continuous coverage scanners available, but they are $350 up—do you have something cheaper?

Doug Graham
4929 Elm
Arcadia TX 77517

Number 27 on your Feedback card

QTH-DX

QTH is Luxembourg

Leon Fletcher N6HYK
274 Webster Drive
Ben Lomond CA 95005

Where Small is Great

A couple was driving across Europe. He asked, "What country are we coming to?"

She answered, "I don't know, I'll check the map."

He replied, "Don't bother, we just left it."

That chestnut, repeated often by visitors to Luxembourg (LX), is a gag that fits.

At its widest spot, Luxembourg is only 35 miles across, and from north to south, it is just 51 miles long. The speed limit on the country's motorway is 75 miles per hour.

Luxembourg, covering 996 square miles, is smaller than Rhode Island. Yet 23 other independent countries are smaller still.

Luxembourg's population is about one-third of Rhode Island's population of 367,000 inhabitants, or roughly the same as Portland, Oregon or Baton Rouge, Louisiana. Close to one-fourth of the people live in the city of Luxembourg, which has a population of 100,000, nearly the same as Durham, North Carolina or Reno, Nevada.

The complete, official name of the country may be the most regal in the world: The Grand Duchy of Luxembourg. Such dignity is appropriate.

Fairytale castles seem to be everywhere. Seventeen are listed in the nation's official tourist booklet. All of the ancient structures are open to the public. The Grand Ducal Palace, built in 1580 in the city of Luxembourg, is especially notable.

For centuries, that city was one of the strongest fortresses in the world. But between 1667 and 1883, many parts of its ancient defenses were dismantled. Still preserved, however, is the Casemates, a 14-mile network of underground passages dug through solid rock, which tourists can wander through daily from March to October.

Who Will Rule?

Despite Luxembourg's elaborate preparations to defend itself, various European powers ruled it for many years. In 57 B.C., Julius Caesar led his legions through the country. In the fifteenth century, Spain took over the land. In 1717, Austria ruled, and in 1795 France annexed it. Finally, in 1815, the Congress of Vienna granted autonomy to the country. After that, for more than a hundred years, Luxembourg declared a policy of neutrality.

But Germany ignored that position, and overran the tiny land during both World War I and World War II. In WWII, some 60,000 Luxembourg homes were destroyed in what we call "The Battle of the Bulge," and what Europeans call "The Ardennes Offense." 19,000 Americans were killed and 62,000 injured while fighting the Nazi invasion. Luxembourgers remember.

Memorials, museums, and other momentos of those supreme sacrifices dot the entire country. One of the major roads leading out of the capital is named Boulevard General Patton, in honor of the American commander who led the US Third Army. The road leads to the military cemetery of Hamm, some three miles out of Luxembourg, where 5,100 American Soldiers are buried.

One of the graves is that of General George S. Patton, Jr., who died in 1945 in an auto wreck in Germany. The burial site was selected by his widow, who said, "I know George would want to lie beside the men of his Army who have fallen."

Other Luxembourg memorials to Americans who fought there include the Patton Museum in Ettelbruck; a monument in honor of the 6th US Armored Division in Heinerscheid; in Medernach, a monument to the Ninth U.S. Armored Division; and another museum in a stone chateau built in the twelfth century, in the resort town of Clervaux.

But after the tragic experiences of World War II, Luxembourgers decided on a new policy: they renounced neutrality by joining NATO. Still, the nation takes seriously and works hard to follow its motto: *Mir woelle bleiwe wat mir sin,* "We want to remain what we are."

"Memorials, museums, and other momentos of those supreme sacrifices dot the entire country."

Present Day

What they are, according to the *New Book of World Rankings,* is very near to the top of all nations in the world in several key factors. Their literacy rate is the third highest. On a per capita basis, they spend more on education than any but four other countries, rank third in the world in number of passenger cars, and tenth in number of telephones. Their homes are the seventh most spacious in the world. On a per-resident basis, Luxembourgers lead the world in production of beer and of steel.

One steel company, ARBED (Acieries Reunies de Burback-Eich-Dudelange), employs one out of every seven workers in the country. ARBED also provides one-fifth of the nation's gross national product and one-half of its exports.

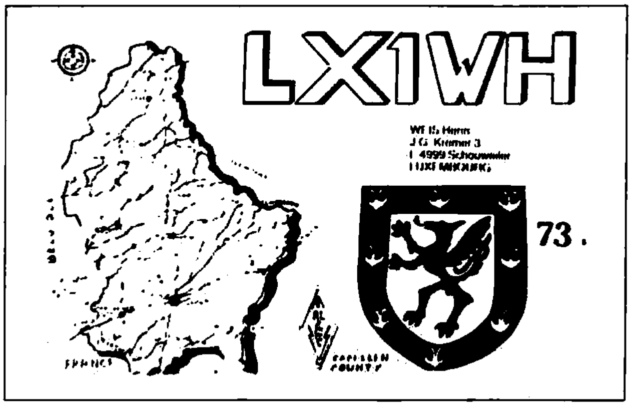
Luxembourg is a land for linguists. French is the official language, widely used in administration. German is the literary language, used the most for commerce and the press. The everyday spoken language is Luxembourgeois, also called Letzburgesch, a mix of German, French, and Dutch. Nearly everyone also speaks French and German, and many residents speak English. In primary schools, instruction is in German; French is added in secondary schools. At the age of 12, students select between two "sections" of study: technical education or classical; if they select classical, their studies include Latin and English.

There are 369 hams licensed in Luxembourg, one for every 995 residents, close to half as many per capita as in the United States. Licensed stations include four schools, three relay stations, two scout groups, and one each for packet radio, the Police Association International, the Bavarian DX Club, and the Shack (sic) du Reseau Luxembourgeois Mensdorf.

Highlights for visitors include exploring the ramparts which encircle the ancient town of Vianden; watching, perhaps playing, open air chess in Remich; touring the famous rose gardens in Walferdange; sampling the country's 23 major museums; attending the strawberry and apple festivals in Steinsel; observing the international canoe competitions in Kautenback; visiting the shooting grounds in Hesperange and Schifflange; or attending the windsurfing school in Insenborn-Lutzhausen.

Then there's sight-seeing the remains of a Roman camp in Aalburg; cross-country skiing around Perle; touring The Caves Cooperatives, which store three million liters of wine, in Wormeldange; or trying the "very mineralized waters" in Mondorf-les-Bains, which, local publicity claims, are good "for the treatment of complaints of the liver, gall bladder, stomach, and intestines, as well as rheumatism in all its forms."

Despite such variety, or maybe because of it, there are more Luxembourgers, according to *The People's Almanac,* living in Chicago than in Luxembourg City.



SPECIAL EVENTS

Ham Doings Around the World

GROVERS MILL NJ
OCT 30–31

The GE Astro Space Division ARC will operate WB2JQR from 1400Z the 30th to 0200Z the 31st from the first Martian landing to commemorate the 50th anniversary of Orsen Wells' Mercury Theatre "War of the Worlds" broadcast. Suggested frequencies: CW—3.535, 7.035, 7.135, 14.035, 21.135, 28.135 MHz and phone—3.950, 7.235, 14.285, 21.355, 28.400 MHz, as operators and conditions allow. For QSL and certificate, send QSL and legal-size (or 9 x 12 for unfolded certificate) envelope to *Alex Montare KA2VLP, Astro Radio Club, MS 410-1B, GE Astro Space Division, PO Box 800, Princeton NJ 08543-0880; 609-426-3564.*

MELROSE MA
NOV 1–20

The Quannapowitt Radio Association of the Boston Northern Suburbs announces its 40th Anniversary QSO Party on the above dates from 0000 UTC to 2400 UTC. Work at least one QRA member on any amateur band, and in *any* mode permitted by the participant's license. QRA members will identify themselves by sending "QRA." To claim the QRA 40th Anniversary Certificate, send your QSL and business-size SASE to *Jim Chetwynd W1UZK, 124 Forest St., Melrose MA 02176.* Claims must be received by February 28, 1989.

HOQUIAM WA
NOV 5–6

The Grays Harbor ARC will operate from the City of Aberdeen Museum of History from 1600Z on the 5th to 2400Z on the 6th, to commemorate the 100th birthday of the city. Look for W7ZA on the lower 25 kHz of the general phone bands, on 15–80 meters, on 28.310 MHz, on the Novice portion of the 10 meter band, and on the first 25 kHz of the general CW bands. For a special QSL card, please send SASE and QSL to *ARS KA7AIR, Joe Ledesma, 516 6th St., Hoquiam WA 98550.*

CONCORD NC
NOV 6

The Cabarrus Amateur Radio Society will hold its 10th annual Hamfest at the New National Guard Armory from 9 AM to 6 PM. Dealer set-up at 6 AM. FCC examinations by pre-registration only. Prizes, forums, auction. Tickets, $3 in advance, $4 at door. Flea market tables, $5 each. Talk-in on 146.055–146.655. *Concord Hamfest, 2015 Applegate Drive, Concord NC 28025.*

AURORA IL
NOV 10

The City of Lights mini-certificate commemorates the 5th anniversary of a Chapter of the Ten-Ten Int. Net, Inc. You may obtain the full-size certificate for $1 plus two stamps. Send your 5-year number to our new C.M. *Earl Henly WB9NYC, 1960 No. Marywood Ave., Aurora IL 60505.*

VICTORIA AUSTRALIA
NOV 12

The Australian Ladies' Amateur Radio Association is holding a 24-hour contest on the above date from 0001 UTC to 2359 UTC. YLs work everyone, OMs work YLs only. 3.5, 7, 14, 21, and 28 MHz bands only (write for more specific information). Phone and CW. Certificates awarded in nine categories, plus the Mrs. Florence McKenzie CW Trophy award. For details, contact *Mrs. Marlene Perry VK3JAW, 218 Ninth St., Mildura. 3500, Victoria AUSTRALIA.*

MILWAUKEE WI
NOV 12

The Milwaukee Repeater Club is sponsoring the 4th annual "6.91 Friendly Fest" from 8 AM to 1 PM at Serb Hall. Sellers admitted at 7 AM. Easy access, swapfest bargains, exams. Tickets, $3, four-foot tables, $4. Talk-in on 146.91 and 146.52. To save $1 per ticket or table, send SASE with payment before November 5 to *The Milwaukee Repeater Club, PO Box 2123, Milwaukee WI 53201.* For information, call *414-444-4589 (24-hr. answering machine).*

HOQUIAM WA
NOV 12–13

The Grays Harbor ARC will operate from the Tall Ship Shipyard at the Grays Harbor Historical Seaport from 1600Z the 12th to 2400Z the 13th, to commemorate the launching of the *Lady Washington*. Look for W7ZA on the lower 25 kHz of the general phone bands on 15–80 meters, on 28.310 MHz, in the Novice portion of the 10 meter band, and the first 25 kHz of the general CW bands. For a special QSL card and fact sheet, please send an SASE (#10 preferred) and QSL to *ARS KA7AIR, Joe Ledesma, 516 6th St., Hoquiam WA 98550.*

NORTH HAVEN CT
NOV 13

The South Central Connecticut ARA is sponsoring its Hamfest and Computer Flea Market in the North Haven Park and Recreation Center on Linsley St. from 9 AM to 3 PM. Admission, $2. Tables, $12 in advance, $15 at door. Talk-in on 146.01/.61. VE exams, commercial exhibits, refreshments. Wheelchair accessible. For information, contact *Brad Oestreicher WA1TAS at 203-265-6478 from 7 to 10 PM.* Or write *SCARA Flea Market, PO Box 81, North Haven CT 06473.*

MELROSE MA
NOV 18

The Quannapowitt Radio Association of the Boston Northern Suburbs is celebrating its 40th Anniversary at 7 PM on the above date. Informal dinner, speakers, door prize, and raffle. The meeting will be in the Wakefield-Lynnfield United Methodist Church in Wakefield. Talk-in on 147.075. The entire radio amateur community, spouses, and guests are welcome. Contact *Jim Chetwynd W1UZK, 124 Forest St., Melrose MA 02176.*

SUMTER SC
NOV 19

The Sumter Amateur Radio Association will sponsor a late fall Hamfest at the SC National Guard Armory on North Pike Road in Sumter. Activities include VE testing (bring photocopy of license), ATV seminar, indoor flea market. Handicap access. Advance tickets, $3. At door, $4. Talk-in on 147.015. Contact *SARA, PO Box 193, Sumter SC 29151-0193.* Or call *George Mudd KK4QZ at 803-773-5053.*

GRANITE CITY IL
NOV 19–20

Starting at 1800Z on the 19th, the Egyptian Radio Club W9AIU will go in search of the great Piasa bird. Work W9AIU or Egyptian Radio Club member for certificate. Suggested frequencies: CW—up 50 kHz from bottom of bands; phone—lower portion of the general 80–15 meter bands; and Novice—28.428 MHz. For certificate, send large SASE to *W9AIU, PO Box 562, Granite City IL 62040.*

MONTGOMERY AL
NOV 19

The Montgomery ARC will host the 11th Annual Central Alabama Hamfest at the Garrett Coliseum. Free admission, free parking, and overnight RV parking with $5/night hook-up. Flea market and dealer set-up at 6 AM. Tables, $7 each. Doors open from 8 AM to 3 PM. Novice through Extra Class FCC exams. Bring a copy of current license for upgrades. Talk-in on 146.24/.84 W4AP/RPT. Other local repeaters on 147.78/.18, 449.50/444.50, and 146.32/.92 with autopatch. Contact *Montgomery Hamfest, PO Box 3141, Montgomery AL 36109.* Or call *Al W4CNO at 205-272-9130.* For table reservations: *Jiggs K4JZA at 205-365-0380 or Fred K8AJX at 205-263-9557.* For dealer information: *Randy N4LZK at 205-832-4598.*

RALEIGH NC
NOV 19–25

The Raleigh Amateur Radio Society club station W4DW, as W200DW, will conduct a Constitution Special Event from 0001Z on the 19th to 2359Z on the 25th on all the HF bands. On Friday the 19th, they will operate from the State Capitol. Stations checking in will receive a commemorative card embossed with the state seal and descriptive literature. Your card will be given to the North Carolina Bicentennial Commission to archive and display at the Tercentenary Celebration in 2088. Send #10 SASE to *RARS, PO Box 17124, Raleigh NC 27619.*

MASSILLON OH
NOV 20

The Massillon ARC will sponsor Auctionfest '88 at the Massillon K of C Hall on Cherry Road from 8 AM until 5 PM. Sellers set-up is at 7 AM. Admission is $3.50 in advance, and $4 at the door. Many tables are available at $7 per eight-foot space. Free parking. Auction begins at 11 AM. Talk-in on W8NP 147.78/.18. For information and registration, contact *Massillon ARC, PO Box 73, Massillon OH 44648. SASE please!*

GREENSBORO NC
NOV 26–27

The Mark 4 Radio Club is sponsoring its Hamfest from 9 AM to 5 PM and 9 AM to 3 PM, respectively, at the National Guard Armory. Some features are exams, Christmas craft exhibitors, paved tailgate and flea market area. Advance tickets, $4; at door, $3. Inside tables are $12 each. $2 unlimited flea market space. Talk-in on 145.250 (−0.600) if back on air, 147.030 (+0.600) backup. 146.520 simplex local. For information and registration, contact *Fred Redmon N4GGD, 3109 Goodall Dr., Greensboro NC 27407; 919-852-9244 between 9 PM and 11 PM only.* For tickets, contact *Henry Hughes KA4LPA, 2811 Gwaltney Rd., Greensboro NC 27407; 919-292-0633.* For exams, contact *T.E.A.R.C., Jim Williamson NQ4T, 3504 Stonehurst Place, High Point NC 27260; 919-869-6637.*

ATV

Ham Television

Mike Stone WB0QCD
PO Box H
Lowden IA 52255

Great ATV Software

I have compiled a list of personal computer programs that seem ideal as a video input feed to enhance your amateur television studio operations. I include the postage and handling for all prices listed.

EPYX Designer Series (Stock number EP-1550-1) has a neat, complete package program for the Fast Scanner titled Home Video Producer. It retails for $35. A 46-page, easy to read instruction manual and 14 film clips are included. The version I have is for the IBM PC and clone, but EPYX makes the same package for the Apple IIe, IIc, or IIgs and Commodore 64/128 computers. You can pull up all kinds of large letter and picture graphics from menu windows, and create movie effects, such as fades, wipes, corner inserts, time delays, etc., on the film clips.

The Home Video Producer feeds color composite video into a VCR for taping, which gives the ATVer a way to inject the screens he produces into the fast scan transmitter. There are special birthday, wedding, vacation, and sports title sequences. It even has a Hollywood director's clapboard! You can obtain the IBM version directly from *Computer Direct, 22292 N. Pepper Road, Barrington, Illinois 60010.*. For the Apple and Commodore versions, write the software manufacturer: *EPYX, 600 Galveston Drive, Redwood City, California 94063.*

I advise you also to check out StoryBoard. I have heard that it is one of the best IBM computer packages for ATV graphics. Marty Fitzgerald WD0BCE of the Davenport BRATS ATV Group has a version of it, and amazes us all with the neat and dazzling StoryBoard presentations. Write to him and include an SASE for more information.

Then there's Banner for the Radio Shack Color Computer. In this program, jumbo size letters fill your TV screen as they go scrolling by (right to left). They show any one of nine colors, black and white, or in an all-color mode in which each letter is a different color. The Typewriter screen mode lets you type in what you want "live"—good for giving out P-signal reports, etc. A colorful Demo program shows capital and lowercase letters, stops and starts, pauses and varies text speed. There is an on-screen Help section. Breaking into the Test of the demo message shows how to create your own messages. The program is very good and generally easy to use. It's only drawback is that it uses a cassette to save text screen messages. It would be great if it were changed to a disk-save format. Banner is available from *Spec-Com Software, PO Box H, Lowden, Iowa* for $23.

Also from Spec-Com Software, for the CoCo, is a special "ATV Disk Package," #102. This disk is full of dozens of useful ATV graphic programs and utilities, including colorbars, marquees, 3D message generator, and a large CQ Eyeball program, the A5 Symbol IDer, and many others, for $32. Include an SASE for the latest IBM, CoCo, C64 Computer Software Catalog.

For $18, *Griffin Enterprises, PO Box 6104, Sumter, South Carolina 29150;* offers a neat VCR Titler program for the Radio Shack TRS-80 Color Computer. Answer a few questions, and a full screen, excellently designed, large Hollywood clapboard appears with all your information in it! This is great for inserting information about DX openings or special events on your VCR tapes. A large, white-letter, black-background 5-4-3-2 Countdown is also available.

The ATV Bulletin Board is a full color, multi-size, large letter four-way moving, active screen message generator, just like the one you see on your local cable TV channel. Text is programmed easily from BASIC, then loaded into the machine language routine. Put the club's latest messages in the large body text (10 full screens), callsigns of members or authorized users in either of the smaller top or bottom display screens. All screens move independently of each other. Sample BASIC program is included with each order. Price is $42, from *Spec-Com Software.*

Bill Brown WB8ELK of the Findlay, Ohio, ATV Group, just came out with a video ID board design which has up to four custom designed pictures stored in an EPROM. An ad and short article appeared in the May issue of *The USATVS Journal* (page 27). Figures 1 and 2 show examples of the finished screen graphic product depicting the recent W9PRD and WB8ELK Helium Balloon flights. These pictures are in color, of course. Bill and his brother use CoCoMax (another fine program by *Colorware, 78-03 Jamaica Ave., Woodhaven, New York 11421*) and a video camera digitizer to take pictures off VCR tapes, photos, etc., and store them in the EPROM. You can add graphic titles as well. The completed circuit boards are $89. For a catalog of drawings, call or write *Elktronics, 12536 T.R. 77, Findlay, Ohio 45840; (419) 422-8206. Packet via N8ET BBS.*

I know a lot of ATVers have similar programs that are great for the Fast Scan TV mode. How about writing and telling us about them? Tell us (in detail) how they work, what computer they work on, and where to get them. I'll publish these in future columns. Have you ever seen the screen capabilities on an Amiga computer? Check with Jeff KA9TGX in Lafayette, Indiana on this—Wow!

MANY MODES OF ATV

Slow Scan and Facsimile TV Communications

There's a resurgence of good old B & W SSTV activity on 14.230 MHz. It seems when most of the color gang abandoned their

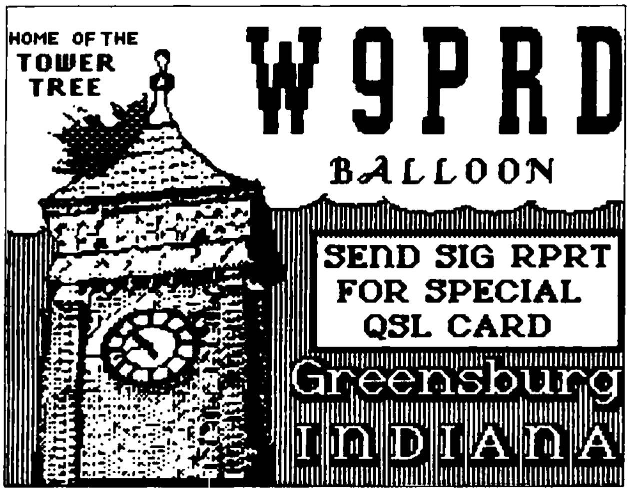


Figure 1. The finished screen graphic depicting the W9PRD Helium-filled Balloon Event. Bill Brown WB8ELK of the Findlay, Ohio, ATV Group designed a 6809 microprocessor board to store the graphics.

ROBOT 400s for the new Color 1200 models, all the inexpensive black and white units quickly got gobbled up for $100 or less.

There is a tremendous supply of discarded ROBOT 400 circuit boards around the country. Enterprising SSTV wizards should buy up these boards for $25 each and make stand-alone home-brew units! What's in a power supply, anyway? Tune into the Saturday afternoon SSTV Net, still on the 14.230 MHz calling frequency with Don Miller W9NTP and Brooks Kendall W1JKF.

I hear that AEA is working on a stand-alone SSTV converter at a very moderate price. If that great company gets involved, Slow Scan might just come alive again and take over the low resolution marketplace. There's the Fred Sharps (W8ASF in Cleveland) and the Tom Hibbens (KB9MC in Desoto, Wisconsin), who keep adding switches and mods to their 400s, never letting them die. It's all for the fun of it, and that's what it's all about!

Facsimile interest still steadily grows. It's a lot of fun to watch incoming FAX pictures, or to send FAX pictures over ATV! Want to get on FAX cheap? Get a TRS-80 Color Computer, a disk or cassette, and the Martin Goodman WEFAX program, and you're in business! However, some of the established FAX boys are concerned that these computerized, low resolution 2–4 gray level pictures might detract from and degrade "real" FAX visual communications. While I sympathize with them, I welcome the new spirit and interest of those getting into FAX with home computers, even at low resolution levels. Once they are hooked, and someone sends them a high resolution facsimile photo in the mail, most will get further in debt by purchasing more sophisticated receiving equipment. Then the real fun begins!

By the way, Greg Mengell now edits *The Journal of the Environmental Satellite Amateur User's Group*.

> *"There's a resurgence of good old B & W SSTV activity on 14.230 MHz."*

Packet ATV

Packet radio has a place on the ATV mode as well. Our ATV Group sponsors a highly elevated, high power Packet digipeater running Kanterm Software on a Commodore 64 computer. The video from the Commodore is fed into one of our twenty TV screens in our remote transmitter Mode-A. We get a kick out of "watching" our own signals enter the system as well as being able to "see" what the digi is hearing! Forty column print is good enough to view all the text thirty to forty miles away on a P3-4 picture. Those wishing to experiment with this should use white letters on a dark background.

ATV Helps OSCAR

This idea helps those hams who enjoy both ATV and HF DXing, but who don't have a personal computer. There are many satellite tracking programs available; AMSAT put out a number of excellent ones. Some have text readouts only and some have video displays of world maps showing where the bird is now located. Get one that shows the video display of the world map—these are best for ATV. Host one of your remote transmitter TV screen windows to this function with a dedicated computer and keep the inputs up to date. You will immediately see interest in satellites increase as the ATV group begins to see this screen and ask the usual questions. How neat for OSCAR trackers and users to be able to go to an ATV screen, see immediately where the bird is, and then go work on it! The same goes for DX groups on MINIMUF and Grayline projections. You got the ATV system up and running—now find ways to make it entertaining and useful for everyone!

We should have the scores from the August USATVS North American FSTV Contest in our next issue. You did enter and give the gang some points, didn't you? ■

Number 30 on your Feedback card

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

[Ed. Note: This month we present a special article dealing with the methods that will be used to reverse the FCC order that reallocates the lower 40% of the 1¼ meter band to land mobile use. It is authored by 220 Notes *editor Art Reis K9XI—one of the nation's leading authorities on the subject of the 1¼ meter reallocation debacle. . de WA6ITF]*

How To Oppose Docket 87-14

The Department of the Office of Engineering and Technology (OET) of the FCC thinks it has decided the ultimate fate of the 220-222 MHz band (which it has not), it is our turn to go onto the offensive in this battle. There are actions we can take to turn the outcome to our advantage, but there are also those best left to the proper people.

The most important thing we should *not* do is to file any lawsuits on this matter in any court. This is the one time that not only do we have to trust the ARRL, but that we can. There is a time and a place for everything, and in this instance the place is with the League's General Counsel, Chris Imlay N3AKD. The time is whenever Counselor Imlay knows that it is time to file.

What Not To Do

Here are two things you should know. First, the ARRL's Washington attorney is very good. He is a young, aggressive, communications law specialist. He knows the Washington DC courts better than you or me. Nobody practicing general law can match his expertise.

Second, the League Board of Directors has decided to do what it has to do to deal with this situation in the best possible manner. Those of us who are in a position to know the facts, understand the strategy involved. It has an excellent chance ol working as long as others don't interfere with the game plan. The quickest way to destroy our counteroffensive against the FCC is to have the wrong folks file suit against them. Let the League do it, and at the proper time.

What Joe Ham Can Do

Once the League has filed suit, anyone can intervene on its behalf. If you or your organization wishes to present facts you feel are germane to the suit, start working now to get them ready for filing. If you give yourself or your group time to do your homework, you will be prepared to present your arguments at the appropriate time, and you will have done your part to help in the war to keep 220-222 MHz all amateur. To the courts, that is all you can do! But isn't that enough?

Write Your Congressmen and Legislators

We can't seem to do enough to hammer home the importance of writing to your senators and representatives to mobilize their support against the FCC. Even at this late date, your letter to Congress counts! Make sure to target it to that staff person who has the FCC as part of his or her assignment. If you do not hear from your elected representatives (and, shockingly, a number of them do not answer their mail!) write'em again and again. It's a great way to show we indeed act in earnest. Remind them of the upcoming election and the considerable voting block the 400,000+ number of US hams represent. Remember—we support these people to represent the interests of the people—you and me!

Urge your congressmen to support Concurrent Resolutions 127 (Senate) and 317 (House). These resolutions express the Sense of the Congress on the issue of amateur radio frequency allocations. *Remember that the FCC, in their action on General Docket 87-14, just slapped in the face the very Congress which appropriates their money for them.* The FCC's action flies in the face of House Resolution 317 and Senate resolution 127, issued in June and July 1988, which specifically state that the FCC should leave amateur radio frequencies alone. If your senators and representatives have not become co-sponsers of these resolutions, write them, urging them to get on the stick and do it.

The following four, key legislators need to hear from *you*:

U.S. House of Representatives:

Rep. John D. Dingell (D-MI), Room 2221 Rayburn HOB, Washington, D.C. 20515. Tel: (202) 225-4071. Attn: John Orlando.

Rep. Edward J. Markey (D-MA), Chairman of Telecommunications and Finance Subcommittee, Room 316 House Annex II, Washington, D.C. 20515. Tel. (202) 226-2424. Attn: Gerry Salemme.

U.S. Senate: *Sen. Ernest F. Hollings (D-SC), Chairman of Commerce, Science and Transportation, Room SD-508, Washington, D.C. 20510. Tel: (202) 224-0427. Attn: Ralph B. Everett.*

Sen. Daniel K. Inouye (D-HI), Chairman of Communications Subcommittee, Room SH-227, Washington, D.C. 20510. Tel. (202) 224-9340. Attn: Tom Cohen.

Investigating the OET

As many hams have been advocating for quite some time, we need at least two investigations of the Office of Engineering and Technology: one by Congress, and one by the Justice Department.

The best way to get the ball rolling is to start an outside investigation. The trouble is to find an investigator with enough credibility to ensure a follow-up. The ARRL is not a good choice since that kind of action might jeopardize their tax-exempt status. Another organization within the hobby, such as a major magazine, would be much better suited for this.

Colonize the 220-225 MHz Band

Finally, the last thing you can do is to colonize all of the band from 220-225 MHz. Why do that, in the face of the FCC's news release urging us to vacate the 220-222 MHz portion? Because this fight is far from over!

The more use we make of ALL the band, the harder it will be for the FCC to justify taking it away from us in court. If you have plans for packet backboning, weak signal work, linking, or for remote bases on 220-222 MHz, make these plans a reality now. Encourage your ham friends to do the same.

The FCC, for all its lip service, has shown no respect for our service, either in this matter, or in the rewrites of Parts 97 and 15. By using the band right up to the last day, instead of turning tail and running, we will give them something to think about for any possible future actions which they may take against us. This fight they have started will take years to finish. Time is on our side!

. . . de K9XI

"Save 220" NTRN

A few years ago, teleconferencing together a few hundred repeaters to talk over important ham radio situations was a common occurrence. Rich, and Lou Appel K0IUQ spent many evenings bringing amateurs throughout the United States and Canada some of the most interesting, informative and entertaining sessions ever to hit the hambands. When Rich left, however, the net slowly disappeared.

If all goes as planned, on Sunday evening, October 2nd, the first NTRN in several years will have taken place. The "Save 220 And All of Our Hambands Teleconference Radio Net," will have had a list of experts on the panel, including co-host Joe Schroeder W9JUV of *Ham Radio Magazine*, ARRL Counsel Christopher D. Imlay N3AKD, noted weak-signal communications expert Rojer Cox WB0DGF, 220 MHz Spectrum Management Association President Karl Pagel N6BVU, Rusty Landis KA0HPK of the Indiana based VHF/UHF Information Exchange, plus a series of experts representing EME and packet radio interests. Back-up distribution for this conference was slated to be over the AMSAT OSCAR 13 satellite if it's within radio range.

Look for announcements here of future NTRNs and participate!

. . . de WA6ITF

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Number 34 on your Feedback card

LETTERS

From the Hamshack

No-Coder

After having read your editorial in the March 1988 issue of *73*, I felt I had to write concerning the "no code" amateur license.

I have supported the concept of such a license since it was broached to the FCC and received such publicity in the amateur world.

I am extremely interested in our hobby and spend as much of my precious spare time with it as I can. There is no doubt in my mind that we need to encourage our nation's youngsters to join our hobby and enjoy all of its benefits.

I have been teaching amateur radio classes for Novice through Advanced for more than six years.

Though electronics may interest some students, amateur radio is *not* the drawing card. Though the classes do have all ages from 12 to 75, including women, the interest is communications. The modes and methods are far away from CW. The students are exceedingly interested in all theoretical aspects, as well as the practical areas about which we teach. With the availability of all the digital aspects of amateur radio from RTTY to Packet including satellites, CW sits far back in the modes of interest.

I am firmly and strongly in favor of a license without the requirement of learning Morse Code, but stressing theory and practical usage. We will attract a large number of superb hams and it will give the hobby a great boost. Like learning about all of the other areas, or using any of them, a ham can learn and use CW if he so desires. Why must he be forced to?

I certainly would like to see a new no-code proposal receive a favorable ruling.

Edward N. Ludin, MD K2IK
Cherry Hill, NJ

More No-Code

The August edition of *73* came today, the first edition of any radio magazine I subscribe to that has arrived, and I subscribe to them all.

You probably don't remember me. I have jousted with you a couple of time in the past, on whether CW should remain a requirement of ham licensing and a bit about being behind in product reviews (refering to the Ten-Tec Paragon).

Well, you made up for all your past mistakes with the product review of the Radio Shack PRO-2004 Scanner in your August issue. I have often wanted to modify my PRO-2004 so that it could scan the parts of the 800 MHz band that were removed. The review of the scanner in the August issue includes sufficient information to enable me to do just that (at my own risk, as you said, hi.)

This assistance will insure that I will continue to be a *73* subscriber for may years to come. The views on CW continue to be misguided, though many other ideas pronounced in "Never Say Die" are on the mark. Thanks for having the guts to publish "The Hidden Secrets of the PRO-2004."

William B. Levin NJ7G
Colonel US Army (Ret)
Tacoma, WA

Never Say Die

Continued from page 6

ting ham radio growing, nothing is going to change. Why should it?

UPS—1; Amateur Radio—0

You mean they actually took part of the amateur 220 MHz band away for United Parcel? Hey, they can't do that! Oh really? Well, it did take a while for us to lose it, but we managed.

I remember several years ago when I proposed that we set up the middle 3 MHz of 220 as a no-code entry ham band for newcomers in order to get some activity in it—use it or lose it. The FCC liked the idea and tried hard to get a no-code license going. The League got their member clubs to kill off the FCC's plan, with our old timers cheering their victory. I hope the ashes of that victory taste good now.

As I reported in my editorials, the FCC was extremely concerned about the drop in new hams, particularly when their Long Range Planning Committee (LRPC) looked over the potential for providing emergency communications and found that amateur radio—and only amateur radio—had the potential for providing this badly needed service.

The LRPC also found that the volume of traffic that any serious emergency would generate was way beyond the capability of what a few hams, working with 40-year-old technologies, could possibly handle. More hams were needed. We needed a whole lot more hams. We also needed to encourage these new hams to develop reliable automated high speed communications systems, something old timers will obviously fight to the death to keep from doing.

After researching the situation, the FCC decided that the only viable solution to getting more hams was to do away with the code test, that youngsters everywhere agreed was their major stumbling block. When this proposal was killed by the ARRL, the FCC disbanded the LRPC and the amateur radio National Industry Advisory Committee (NIAC) and gave up even trying to solve the emergency communications problem, despite its critical importance to our country.

I wrote about the above situation in my editorials every step of the way and warned that the next step was obvious: the FCC would parcel out our ham bands so they could be used more productively. I was called "controversial" for writing such obvious rubbish.

So what band do you think will get pruned next? Let's see, we've recently lost a big chunk (25 MHz), 30% of the 1300 MHz band, and now 40% of the 220 MHz band. Anyone want to take bets on the FCC finding better uses for 430 MHz? Heck, I wouldn't buy futures on any of our microwave bands. They're worth billions on the market, and we flat out aren't using them. We don't even have a prayer of getting the new and young hams we'd need to get activity going on our microwave bands. No, without some major changes in the ARRL resistance to no-code, I don't think we're ever going to really need or use our most valuable ham bands—the microwaves.

Now don't go panicky and start selling your two meter HTs off cheap. There'll be a good market for these for many years—a very lucrative market. As long as we continue to outlaw drugs, there'll be an increasing need for two meter ham gear to coordinate smuggling and drug deals.

> ***"So what band do you think will get pruned next?"***

My Take

I've heard all the complaints about the kids, but they're the product of their parents—and that's you. It's you who have turned your kids over to the TV set. It's you who've let our educational system turn to mind rot. So let's not blame the kids. If they're lazy it's because we've taught them to be lazy—or, more likely, we haven't bothered to teach them anything.

How do you teach kids to work hard for what they want? One way is by not giving them things they haven't worked for. I know that's a novel concept. Do you mean to tell me that showering things on a kid is going to spoil the kid? Ridiculous!

You train kids the same way you do animals. You convince them that what you want them to do is what they want to do. You show them the benefits of doing what you want. No, punishment doesn't work with animals, nor with kids. You give positive reinforcement when they do right and urge them on to do better when they do wrong, which they will.

If we want kids to get interested in amateur radio we have to convince them that there are some benefits—like it being fun. Right now we've convinced them that getting a ham ticket is a major drag. The few that are curious enough to come to a ham club are, at the very best, ignored. More likely they are both ignored and are bored to tears, finding the club is merely an old-man's preserve.

I've a challenge for you. Every one of you at one time or another comes into contact with a youngster in the 10–15 year range. Get off your big high horse and talk with this youngster and get his or her perspective on amateur radio and let me know what you find.

Then, if you're a glutton for misery, let's see if you can convince this small person that he or she wants a ham license. Then explain about the code and let me know what happens. Come on, come out of your shell and find out about the real world of the late 80s. Find out why your grandchildren aren't interested in ham radio. Most of 'em aren't doing anything else much.

Buying A License

Since my editorial mentioning that a growing number of VECs have been selling ham tickets I've had a string of phone calls and letters (usually with $50 bills enclosed) asking for the names of these VECs so the callers can buy their licenses.

Now, before you get all upset over this, and I know you'll try, you should know that each of these people have what they felt were legitimate reasons for buying their licenses—in every case it was the code. For instance there was one chap of 70 who's had seven heart by-pass operations and who's doctor has forbid him from tackling the code—the tenseness involved could kill him.

This chap has petitioned the FCC for a special dispensation. The FCC's response: drop dead. So now he'd like to find a VEC willing to help him out.

My explanation to all these callers - and there are often several a day - is to get in touch with W5YI, who has set himself up as the VEC king, and who knows far more about the situation than I.

To those who are aghast at VECs taking advantage of this business opportunity, I might point out a couple of things. First, outside of Puerto Rico, where the discounting seems to have gotten out of hand, with thousands of Extra licenses being sold cut rate, VECs have been more circumspect, and thus most are still in business. The FCC finally put the lid on Puerto Rico only a year or so after my report on the subject in *73*. Speedy for a government agency.

Considering the recent loss of 40% of 220, I wonder if even the most fanatic old timers aren't beginning to question their religious convictions? The pool of amateurs is leaking like a sieve, with the number of newcomers down 19% in just the last year. Will the day come when we'll be petitioning the FCC to allow CBers to use some of our unused ham bands just to keep them from being sold to business interests such as UPS?

Such an idea is preposterous, obviously. Who wants all those crummy truckers on our valuable 900 MHz band, right? Well, it's unlikely we'd attract the truckers, but we might look like fun for some of the kids who satisfy their urge to communicate by opting first for CB, and then find it such a hassle that they get all over the urge before they ever even hear about ham radio.

Death before dishonor is the slogan. We'd rather see amateur radio given away to Motorola and General Motors than compromise our religious beliefs about the code. Being a firm believer in the therapeutic value of strong religious beliefs, how can I honestly raise any objection? No, I believe we should start making ham club flags with code keys on them that we can use during our ham reunion meetings after all our bands are long gone.

Why am I so hepped up about keeping the code? Some say it's because I'm selling Morse Code tapes—the very best ever made by a long shot—and it's my personal greed that makes me so adamant about the code. My tapes have helped tens of thousands of hams get their ham licenses. I can't say painlessly, because my tapes are the most bitchin' ever made. They are an exercise in self-torture. But they

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Never Say Die

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sure knock down the time it takes to learn the code. They are not for people with seven heart by-pass operations. They probably wouldn't live a day after getting 'em.

You think you're upset with Wayne Green? You should talk with anyone who's used my code tapes. They may have their Extra Class license, gotten fairly and squarely, but they'll sputter in anger at the fiendishness of my tapes. Heh, heh! But the money that pours in for the tapes is used for a good cause. It goes to make up for the boycotting of *73* by several major advertisers who prefer to get fewer sales per ad dollar spent in another ham magazine that shall go unnamed, but which is fast sinking due to the poor ad results it provides. It would be unethical to mention which magazine this is.

The whole Novice code thing is moot anyway. My sales of Novice code tapes have plunged to near zero as a result of the recent article in *73* that explained how to pass the Novice license without even bothering to learn the code. And, with 10 meters wide open these days, what are newcomers waiting for? Pass the word.

ARRL Declares War On FCC

The League, in a move that could easily move the FCC to step up their re-allocating of relatively unused ham bands in retaliation, seems to be at war with the FCC. President Price, apparently not considering the ramifications of his statements, said, "We've lost a battle, but not the war." He went on to threaten carrying the battle to Congress, into the courts and to the administration. Just what we need, the gauntlet thrown down.

Is it smart politics to threaten to harass the FCC to force them to do what we want? Mightn't this lead to some thoughts of getting even? Hey, we're dealing with the landlord here—one who is in the comfortable position of making all our laws. If we cause too much aggravation we could get thrown out.

So should we, as ARRL members, enlist in this holy war by the ARRL against the FCC? I suspect we might do better to learn from this one and, for a change, do our homework. If, instead of trying to fight the FCC on the 220 proposition, we'd come to them with a practical plan for utilizing the band, I think we might have won the day.

We're wide open for further cuts of our bands. We're flat out not using six meters these days. There are only a handful of active hams there. How many six meter construction projects have you seen in *QST* in the last five years? And what about 900 MHz? How many projects for getting on that band have you seen anywhere? A couple of our ham manufacturers have stuff for 1296 MHz, but outside of a few moonbounce groups, what are we using the band for? As far as I know, 99% of the world activity on 1296 is in Japan.

If the League would use some of its millions of dollars, that it has saved for a rainy day, to get us more hams—younger hams—instead of spending it on a legal war with the FCC, that has the almost unlimited resources of the government behind them—wouldn't we be better off? What do you think?

I'm a big fan of the ARRL, and they do a lot of great things, but I wonder if this war they've chosen against the FCC might not turn out to be as disastrous as that Iraq-Iran war. Let's cool down President Price and try to get the FCC to work with us to rebuild our dying hobby. I've never found the FCC to be against that—only frustrated at the League for fighting them in their efforts to help us. I suspect the two MHz loss on 220 has more to do with this frustration than with the needs of the UPS. The FCC may be trying to get our attention. So are we going to become even more self-destructive and possibly trigger further losses?

Use CB

A call from an outraged Chicago ham asking for advice got me to thinking. He'd come across what he'd perceived as an emergency, so he called into the 88 repeater (paid member) and asked someone to call in a 911 for him. He was told to stop his car and use a telephone—to get off the repeater.

So naturally he complained to the FCC, who as usual didn't want to be bothered. I was next in line for the hand-wringing.

It's been a while since I've written about this, so I guess it's time to re-explain the facts of life. First, in case you missed what's been going on, we're now giving our own license exams and we're supposed to be self-policing. So stop wasting the FCC's time when you have a beef and do the self-policing. All bitching to the FCC does is make them more anxious to get rid of our frequencies to someone who will cause them less trouble, and there are stacks of commercial services and their lawyers just waiting to explore our every weakness. Why bother with a bunch of whining, troublesome old men who are doing little of value for anyone, including themselves?

I've had several occasions where I've needed help while driving. I remember once I was driving to New York to visit my folks for Thanksgiving. The traffic in Connecticut was terrible, so I wanted someone to call my folks collect for me to let them know I'd be an hour late, and not to hold dinner. There was no possible way to stop to make the call. I tried several repeaters, but was turned down by all of them. So I went to CB and got fast, happy service. They even called on their dime instead of collect!

> *". . . anyone with any interest in personal progress (should) read at least 50 magazines a month."*

What a pity! Here we have a hobby that holds the keys to the world of electronics and communications. We have a hobby that not only allows, but encourages us to educate ourselves, and we waste this incredible resource almost totally by using it purely for our own personal entertainment—with not a little back-biting thrown in.

Isn't it odd? Here we have most of the religions of the world telling us that love and friendship are important. You want love? You get on the air and try to help someone and see how many angry, bitter ops are all over your case. If you want to help get medical supplies to Africa, you'll have someone jamming you. Max Meyers W2BIB is gone now, but I'm sure we have no shortage of volunteers to take over his nastiness and perpetuate it.

I suggest an investment in one new piece of ham gear for the shack. This is a large mirror to hang over the rig so you can take a good look at the chap who is broadcasting from your station. You really want to suffer the agonies of hell? Invest further in a cassette recorder and tape your end of a few contacts. The hell will come when you sit there in front of your mirror and listen to yourself, when you force yourself to hear what the chaps you've been contacting have had to listen to. I'll bet you can't stand it for two minutes. Repent!

When's the last time someone told you that the contact with you was really fun? That they honestly enjoyed it? Let's see, was it 1963 or 1953? We were all off the air in '43, so it wasn't then.

As you sit there sarcastically putting things and people down, or, worse, mindlessly reciting your rig and antenna setup—instead of trying to find out what your contact is interested in—perhaps you'll understand why amateur radio is a dying hobby.

Let's take this self-policing to heart. And self-regulating. This means starting with yourself. Are you spreading fun and love over the air, or anger? Other than getting even for something which is your own personal devil, I don't know of any rational excuse for not being fun to contact. If the only jokes you know are ethnic or dirty, buy a better joke book. If all you can do is complain, do it into your tape recorder, not over the air.

Now, about having interesting contacts. How many magazines do you read a month? Kami, in his book "Trigger Points," says he reads 150. He recommends that anyone with any interest in personal progress read at least 50. If you read Discover, Popular Science, Business Week, Newsweek, Fortune, Scientific American, Analog (the fact article), New Age, National Geographic, Car and Driver, Consumer Reports, US News, Insight, Kappan, Educational Digest, New York, The New Yorker, Reader's Digest and Omni, it's a start. If those don't give you enough to talk about for the next month, you have an even worse problem than I thought. I scan through 250 magazines a month—computers, electronics, audio, photography, music, ham, communications, skin diving, cars, business, education. And I read a few books, too. I want to understand as much as I can about as many things as possible—don't you?■

Lap Top

Continued from page 33

access password, tones which follow will be interpreted as control functions, permitting the control operator to enable or disable the patch or repeater. If the number sequence is a prefix and valid phone number, the phone number will be echoed back by the speech synthesizer, and the call will be placed. Numbers beginning with a 0 or 1 are rejected, to prevent long distance calls. A three-digit "speed-dial" number (including 911) will be recognized, and if a matching pre-programmed phone number is found, that number will be dialed. The program, with up to 640K of RAM available in the computer, can store phone numbers for three-digit speed-numbers from 000 to 999.

Once a phone call is established, detection of a 0, 1, or # terminates the call immediately.

Mode Control

All the above input flags and control flags are examined by the mode control logic, to determine if the operating mode should change. For example, if during the IDLE mode the receive carrier on flag is set, the mode control logic will clear that flag and change the mode to the REPEAT mode. This results in the transmitter being keyed and the receive audio being routed to the transmitter. Table 1 shows the major operational modes of the software.

Another example is when the receive carrier off flag is set, indicating that the repeater user has released his key. The next mode depends on several prior conditions. If, for example, the DTMF tone queue contains a valid access code and phone number, the next mode will be the OFF HOOK mode. This will cause the phone to be taken off hook to get a dial tone, and the phone number will be placed into the speech queue, to echo the number back to the user.

Station Identification

Four types of IDs, controlled by 3 software counters (which count the 1/18-second clock ticks), are generated. If the repeater has not been used recently, the software will generate an ID a few seconds after it is first keyed up. The ID will be CW if the input carrier remains, or voice if the user releases his key and removes the carrier. At this time, two timers will start, a convenience timer and a mandatory timer. If the repeater user releases the key after the convenience timer expires, but before the mandatory timer expires, the controller software will use this opportunity to do a voice ID and both timers will be reset. This timer is usually set to between five and eight minutes. If the mandatory timer expires (it should be less than 10 minutes), and the user has not removed his carrier, a CW ID will be generated.

These three timers will satisfy the requirements that the repeater identify itself at the beginning of, at least every 10 minutes within, and at the end of, each QSO.

Normal mode switching is delayed or interrupted whenever the ID is generated, to prevent it from being cut short by other time-outs or user action.

How Well Does It Work?

As stated in the beginning of the article, this design has been operating for nearly a year with only a few minor teething problems. At present, this approach is probably slightly more expensive than a special-built controller. At the rate the prices of microcomputers are falling, however, it may soon become much less expensive. The problems one might expect when using a computer near high power RF transmitters did not appear, and the computer did not affect the receiver.

The program to drive the lap-top repeater is too lengthy to publish here. It's available in machine-readable form from the author, on either 3½- or 5¼-inch diskettes, for $5.

This type of design is far more versatile than the usual controller, and could be expanded almost limitlessly. For example, you could attach a printer to log repeater operation and phone calls. Almost any computer accessory could enhance repeater operation. Controlling the repeater uses only a fraction of the computer's power, so the rest is on tap for whatever the programmer can dream up. ■

Parts List for the Laptop Repeater Controller

All fixed resistors are ¼ watt, 5%

R1, 12, 22	10k pot
R2	270 ohm
R3, 16	30k
R4	220k
R5	39k
R6, 17, 19, 23, 24, 28	100k
R7, 10, 13, 18	15k
R8, 9, 25, 26	2.2k
R11	560
R14, 27	68k
R15, 33	27k
R20, 21	47k
R29, 30	10M
R31, 32	10k
C1, 4, 7	10µF, 20v
C2, 8, 9	0.1µF, 50v
C3	47µF, 20v
C5	0.047µF, 100v
C6	470pf, 100v
C10	30µF, 20v
Q1	2N2222 NPN Transistor
U1, U3	LM324 Op Amp
U2	LM311 Comparator
U4	SSI-202 DTMF Decoder
U5	5089 DTMF Generator
U6	74HC139
U7, 8	74HC374
U9	74HC240
U10	74LS123
U11	SN75432
Relay	12v coil, SPST
Transformer	600/600 ohm audio

73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

Hambassadors (correspondents) take note: Themes for the 12 issues of 73 Amateur Radio *for 1989 which you might want to keep in mind as you send us your reports are as follows. Remember we must have reports HERE two months in advance: November 1 for the January issue, December 1 for February, etc. January—Workbench/Gadgets; February—Product Reviews; March—Satellites; April—VHF and above Antennas; May—Education/Licensing/Upgrading (What is going on to promote amateur radio to young and old?); June—Field Day/QRP Operation; July—Microwave/ATV; August—Packet Radio; September—HF Antennas; October—DX; November—Annual Holiday Shopping Guide; December—HTs.*

A Word to the Wise: Don't be silly enough to believe all you hear or read about W2NSD/1. It is an election year in the USA, and Wayne is a candidate. We respect the constitutional right of free speech when criticizing, but sometimes it is exercised by individuals who misuse the privilege. This is an individual (unauthorized) editorial statement from the RP part of CCC. (For those who missed last month's column, CCC means the entire "all-C-ing" editorial staff of the magazine, acting as super-editor for the material sent in to us by our international Hambassadors.)

November's events around the world: 1—National Day, Algeria, Antigua (24th for Zaire); 3—Culture Day, Japan; Independence Day, Panama (18th for Morocco, 22nd for Lebanon, 25th for Suriname, 28th for Albania); 4—Flag Day, Panama; 7—Revolution Day, USSR; 8—Queen's Birthday, Nepal; 11—Veterans Day, USA; Armistice, France; Remembrance Day, Canada; (12th for Bermuda, 13th for Great Britain, and (Volkstrauertag) Germany; 14—Dynasty Day, Belgium; 15—Proclamation of the Republic, Brazil; 17—Army Day, Zaire; 18—National Holiday, Oman; 20—Revolution Day, Mexico; 23—Labor Thanksgiving Day, Japan; 24—Thanksgiving Day, USA; 29—Proclamation of the Republic, Yugoslavia.

Roundup

Great Britain. A "self-financing organisation that sponsors a varied award programme based on working [hearing, for SWLs] stations in Great Britain & Northern Ireland" recently presented a Diamond Award to "the first ever claimant from North America.. Jim Thurber K9KQ" of Clarkson, New York (for 1100 areas logged). The Worked All Britain Awards group, which was started in 1969, makes donations to help disabled and handicapped hams. The WAB Awards are based on areas worked; the more than 4,000 areas are those created by the National Grid Reference (NGR) in Great Britain and the Irish Grid. They are 10 km by 10 km in size, up to 100 in each of the sixty-one 100 km by 100 km "large squares." The former are identified by 00–99, the latter by letters. Examples: SP42, G82.

The Awards are Basic, Bronze, Silver, Gold, Platinum, and Sapphire, for which the requirements are stations logged in 100, 200, 400, 600, 800, and 1000 areas, respectively (for European stations the requirements are 300, 500, 750, 1000, 1500, and 2000 areas, respectively). There are other area-based awards also, including (for non-European stations) the W.A.B Overseas Introductory Award calling for 25 areas and 10 (of the 78) counties. A WAB special record book may be purchased.

For further information write Membership Secretary Brian Morris G4KSQ, 22 Burdell Ave., Sandhills Estate, Headington, Oxford OX3 8ED, England, or Dave Bird AA6DB, 11226 Quinn St., Downey CA 90241, USA.

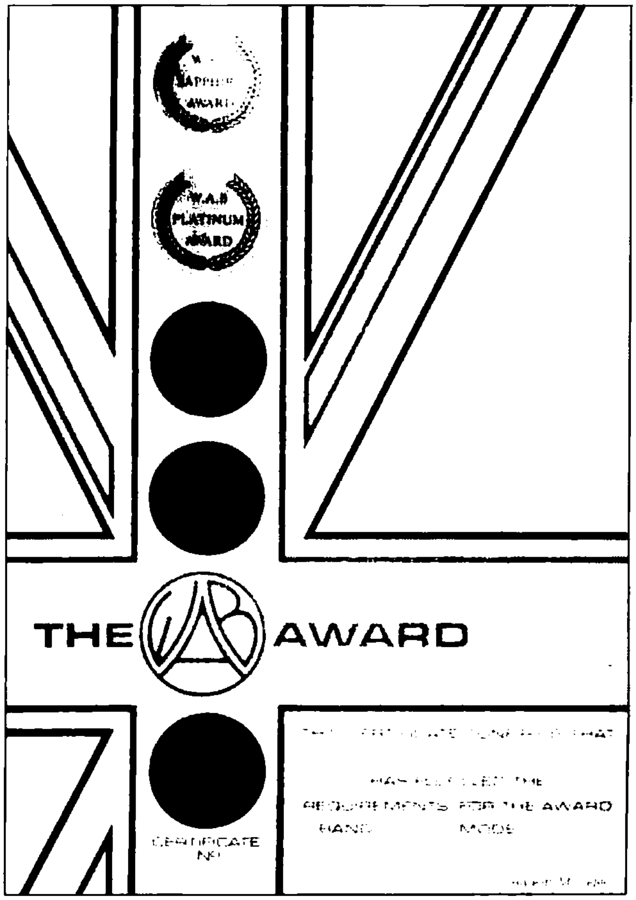
Ireland. Baile Atha Cliath (Dublin, that is), in its celebrations of "One Thousand Years as a City" (see Roundup, p. 98, April issue), worked Dublins all over the world on March 17th. The Millennium Amateur Radio Committee reports contacts with Dublins in Australia, New Zealand, the USA (in Georgia, New Hampshire, Pennsylvania, Texas, and Virginia), and on Banana Island off Sierra Leone. The call was EI1000; a pre-stamped QSL card from the Irish Postal Service is available direct at PO 2223, Dublin 1.

Israel. From Ron Gang 4X1MK: The four stations for the 40th Anniversary in April (of both Israel's independence and the IARC), 4Z40I, 4X40A, 4X40R, and 4Z40C, made tens of thousands of contacts, and QSL cards have gone to all stations QSO'd. A special certificate is available to any who contacted all four stations—application with documentation and US$5 or ten IRCs should be sent to Anniversary Certificate, IARC, PO Box 4099, 61040 Tel-Aviv, Israel.

4X1RU/1 (ex 4Z4RU) is the call of Jim's packet gateway station tying the national 144.675 MHz network with HF on 14.1075 LSB. Alon 4Z4ZB also has 4Z4SV/1 running a BBS on the same frequency in the evenings. Packet has caught on by leaps and bounds in Israel, and one out of every ten stations now has packet capability.

Kenya. From Rod Hallen KB7NK, 5Z4BH (Box 55, APO New York 09675): The Radio Society of Kenya (RSK), IARU-affiliated, is a very active group indeed. Consisting mostly of Europeans and Americans, it is working to get Kenyans involved, with classes in basic electricity and Morse code. There is no Novice license now, but the club is working to rectify that. It also sponsors an SWL program and issues identifiers (e.g., RSK-001, RSK-002, etc.). The club has one 2-meter repeater in Nairobi and soon will have a 70cm one on Mount Kenya. An FM repeater is planned. There is no reciprocal licensing with the U.S., but licenses are routinely issued (a 2–3 month process) to anyone holding a General or higher class license from his home country, or to anyone passing a Morse, theory, and regulations test. Licenses are renewable annually.

CCC invites 5Z4BH to be a roving Hambassador for Africa—but where will we mail his free subscription? One of his main interests is DXpeditions ("being one, that is, rather than working one"), and for the next four years he "will be traveling extensively in East Africa and would like to operate from as many countries as possible." Bill KE3A will be handling his OSLs.—Ed.



Netherlands. From Joseph A. Stierhout PA0VDZ: Two *Guiness Book of Records* successes for VRZA! At the annual Amateur Radio Campingweek, we introduced the world's largest and smallest keys—PD0PHA's, 6.55 meters long, and PA3EQN's, measuring 15.48mm. PA0WX made a QSO from the camp station (PA6JUT) with PI4VRZ/A using the big one, and the little one was used to make a QSO with the VRZA station, PI4VRZ/A in Apeldoorn. (Belgium held the record for the biggest before, and maybe will now take the next step!) The protocol for the event was written by PA0JY, and the officials were Chairman PA0PRT and PA0VYL, an official from Radio Controle Dienst, the Dutch PTT.

A steam train was chartered for the hundreds of camping amateurs for a "train-mobile" trip from Dieren to Apeldoorn and back. A 220-volt generator fed two transmitters (80 and 2 meters), and we had a 5/8-wavelength antenna for the latter and a halfwave dipole stretched over the tops of two carriages. "The only trouble was sometimes the TRX [had to go] QRT [since before each] tunnel the antennas had to be let down."

Republic of South Africa. *[Welcome, our new Hambassador, Peter Strauss ZS6ET, who will appear in our January issue with licensing and packet information!]* He wrote, "While on a business trip from Johannesburg to East London I found a copy of *73* by accident. I have not seen [it] for years...it's a real collector's item...at US$5 [in Johannesburg] for the April 88 issue." ZS6ET recently received the Amateur of the Year Award from the South African Radio Amateur Foundation for his achievements in the foreign licensing field leading later to bilateral agreements with the US, Germany, Switzerland, Portugal, and Israel. At present he is the public relations representative for the Packet Radio Working Group of the SAR League and the spokesperson on foreign license affairs for the Johannesburg branch of SARL. He is also S4ZET and DF4YE, and ex A22PS.

Taiwan. In last month's list of special assistance to hams visiting other countries, the offer of Tim Chen BV2A/BV2B should have appeared. See the March issue, column 2, page 90, and his column—which did *not* appear in that issue but in May, page 96.

World. The International Telecommunication Union (ITU) has published three new economic studies which may be obtained in English, French, or Spanish for the costs listed below by writing the ITU Sales Service, Place des Nations, CH-1211 Geneva 20, Switzerland.

For 45 Swiss francs—**Telecommunications and the National Economy**: the role telecommunications plays in increasing the efficiency of economic, commercial, administrative, social, and emergency activities and services. For 33 Sfr—**The Benefits of Telecommunications to the Transportation Sector of Developing Countries**: a case study in the People's Democratic Republic of Yemen. For 37 Sfr—**Contribution of Telecommunications to the Earnings/Savings of Foreign Exchange in Developing Countries**: a case study of the Kenya situation.

AUSTRALIA

J.E. Joyce VK3YJ
44 Wren Street
Altona 3018
Victoria
Australia

[Jim Joyce saw to it that Australia was represented in these pages every month from November, 1983, to May, 1985, and, on average, every other month since then. He writes, "I feel, reluctantly, it is time to give it away...[so] I have sent in my resignation [to the WIA] as their 'Official Correspondent' to your magazine." We will welcome his replacement when the WIA names him/her, but we warn the new Hambassador for Australia that Jim will be a tough act to follow. His interest in and his competence in reporting may well be matched, but Jim often went beyond the call of duty, putting in his time and putting up his own money to help many hams who called on him for advice and information. (In fact, it will be best if the new correspondent doesn't put up with unreasonable requests, including the majority of them—those which were not intentionally unreasonable.) So thanks from all of us, Jim, and our very best wishes.

—RP.

As his farewell report, Jim sent in a long, detailed article on Willis Island, "...a tiny coral outcrop in the Coral Sea" now celebrating its 67th anniversary as one of the Bureau of Meteorology's remote Observing Offices. We will use parts of it over the coming months, but not its last paragraph, because that belongs here.

—Ed.]

Finally. After five years of being the WIA's Official Correspondent, and having written in that time over 60,000 words, trying to give the rest of the world an insight into Amateur Radio down under, I now feel it is time to step aside for some new blood to take over with new ideas and/or a different approach. Thank you for reading the "Aussie column" over the last five years. Cheers and beers for the last time, mates! Jim VK3YJ.

CHINA

Chang Han-Dong (BY4AOM)
Institute of Estuarine
and Coastal Research
East China Normal University
Shanghai 200062
People's Republic of China

BY, BT, and BV. Maybe you have worked several of these China or Taiwan ham stations. Soon you will hear the voices of BZ and BG. So far as I know, BZ will be earlier; it is the prefix of private calls and must be worked at club stations. BG is the prefix for private stations, and because of the price of SSB equipment, most of BG stations will work in CW. Some of my friends are going to make CW transceivers. When BG stations appear on the air, it means that Chinese ham radio will enter a new stage.

Please call 650674. When you come to China, maybe you hope you can operate in BY. In fact, many hams ask me about this when I work on the air. Yes, it's possible. When you arrive in Shanghai, bringing your license, you could call BY4AA's telephone number and you will be told the requirements and how to get to the station. BY4AA is the club station for the CRSA branch and has many high-quality rigs. You can work in not only CW and SSB but also SSTV, OSCAR, and RTTY. The manager of the station is Xu Lu (we call him Zulu); other members are Chen (YL), Wu (OM), and Zhou (OM). So please call 650674.

Shanghai's 2-meter net. Last month the first 2-meter net in Shanghai opened—it also was the first VHF amateur net in China. The prefix is B4, and the net consists of 26 2-meter FM stations. How this came about is interesting.

One year ago, when BY4AY (the club station for the Center of Shanghai Children Science and Technique) was set up, many other organizations hoped to set up club stations. However, first among many knotty problems was the lack of HF transceivers and any equipment special to amateurs; professional equipment is too expensive. But BY4AY learned from the Shanghai Post Office that there were obsolete 2-meter transceivers in its depository and there was a plan to sell them. So BY4AY bought them, changed the crystals for amateur bands and adjusted them. Now they have 10 fixed frequencies and 10-Watt output power, and 26 secondary schools and branches of the Shanghai Childrens Center bought them and set up the net. It is planned to extend the net, and to use it to attract more people into ham radio.

No Bureau in China. Last month a member of our club came back from Beijing city with a package weighing 3 kilograms. It was all QSL cards from all over the world, some, we were surprised to find, mailed a year or more ago. Amateur radio is new in China and we do not yet have a strong organization. BY1PK is the club of the CRSA (as W1AW is of the ARRL), but lacks members or funds to be a QSL service. So hams should send QSLs direct. Here is a list of some BY stations. (Table 1.) If you don't know the QTH you contacted, send your card to another station in the same city. We hope the CRSA will provide a QSL service as soon as possible; foreign hams too.

Addresses in China for QSLing.

BY...	PO Box	City
4SZ	51	Su Zhou
5QA	507	Fu Zhou
4AA	205	Shanghai
4AOM	227	Shanghai
4RN	2405	Nanjing
4AY	5304	Shanghai
8AA	6106	Beijing

Table 1.

GREAT BRITAIN

Jeff Maynard G4EJA
32 Waldorf Heights
Hawley Hill
Camberley GU17 9JQ
England

The UK Scene

The main event celebrating the 75th anniversary of the Radio Society of Great Britain has passed off with tremendous success. This very special occasion was marked by a national exhibition and convention at the National Exhibition Centre in Birmingham. It featured all the major suppliers and retailers of amateur radio equipment and specialist groups. Some used the occasion to announce new products or special offers. Yaesu showed the FT-747 allband transmitter and full-coverage receiver; ICOM demonstrated the IC-32E dual-band VHF/UHF hand-portable; BNOS had the UK-made 144-MHz, 25 Watt transverter that's advertised as "user-friendly," and also from the UK, Microwave Modules promoted the 4-meter (70 MHz) equipment with a $35 discount to encourage use of this band.

The highlight was the opening ceremony, performed by His Royal Highness Prince Philip, Duke of Edinburgh. Introduced to RSGB President Sir Richard Davies, the Duke said in his opening speech that although he had broadcast a great many words by radio, he had never been a radio amateur. It turns out, however, that on one occasion at school he had built a working crystal set. He said he took much pleasure from being the RSGB Patron.

The whole opening ceremony was broadcast live on special GB2RS transmissions on 80, 40, 20, and 2 meters. GB2RS, the weekly news station of the RSGB, used the equipment of the exhibition special event station, GB75AC. So far, signal reports indicate satisfactory reception in Britain and Europe. The Duke later transmitted a message of greeting to another special event station, GB75ER, at Windsor Castle—the only type of transmission allowed by a non-license holder!

Only two weeks after the NEC binge, the first RSGB Data Symposium took place at the Harrow School in North West London, attended on each of its two days by about 125 people from the UK, the US, India, Senegal, Bermuda, New Zealand, France, Ireland, Belgium, and Germany. The 22-lecture program covered digital signalling techniques on British Rail, amateur satellites, RTTY picture composition, high-speed modem design, and packet radio networking; along with the last-named, a number of visitors, including some from the US, described their own networking.

The symposium was such a success that the RSGB quickly announced a second Data Symposium to be held the weekend of July 8–9, 1989, also at the Harrow School.

The growth in the amateur population continues, seemingly without end. At the time of this writing [August] callsigns in the series GØ J.. and G7B.. are being issued.

NORFOLK ISLAND

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island, 2899
Australia

Our flag. When Norfolk Island gained a measure of self determination back in 1980, our flag also came into being. It is flown proudly from all our public buildings, alongside the Australian flag which, of course, represents "the last say" in important matters like foreign policy, communications, etc.

Our stamps. It has been many years since we started issuing our own postage stamps to boost local finances. We still receive, however, a number of SASEs with Australian stamps—strangely enough mostly from mainland Australia! Many Australians have only a hazy idea of what and where Norfolk Island is. They often confuse us with Lord Howe Island which is in fact classified as a part of New South Wales. These SASEs have to be bulk-mailed to friends on the mainland to be mailed there.

Your IRCs. While on the subject of stamps and SASEs, keep in mind that one IRC means *surface* mail postage, and surface mail leaves Norfolk Island only every couple of months, meaning you might have to add two months to the usual two or three months it may take for surface mail sent overseas from Australia. While in 1988 we enjoy excellent communications through regular air service, direct overseas dialling, telex, and facsimile, surface mail is surface mail, and the Earth is just as large as it was at the beginning of time! And by the way—*be sure your IRCs are stamped on the left hand side by the issuing post office.* They are not legal tender without the stamp.

Amateur radio activity on the Island is a bit up and down. We have lost Phil VK9NP, who returned to VK2 in February. VK9NS and VK9NL were absent on the HIDXA DXpedition to Howland Island, KH1, and the QSLing took up a lot of time, keeping us off the bands. Our tiny post office is coping well with the thousands of items of mail. It does happen that we find a little notice in our box about "an item too large for the box awaiting collection inside." This turns out to be a large mail-bag jammed full of mail. One recent peaceful Sunday Jim opened the box and got a shock when a hand appeared out of the box with a batch of mail. He thought it was the Adams Family "Thing." It was a member of the postal staff who saw daylight appearing in the box and took the opportunity to get rid of some of the overflow.

Visitors. Bruce VK9AD, son of VK9NS' visited over the Christmas period and was quite active, but as there usually is adequate activity from Norfolk Island, real DXpeditions here do not take place these days.

Harvey Brain made a surprise visit strictly for holiday purposes. Oldtimers will remember him as VQ9V and VQ9HB from the Seychelles, operating from St. Brandon and Agalea in 1963, followed by Farquar Island and Desroches Island later. He also was VQ8HCB when operating from Chagos in 1964. He lives in New Zealand now.

•••••

Two hundred years have passed since March 6, 1788, when a small group of convicts and their overseers stepped ashore on the uninhabited Norfolk Island and began to clear land to establish a settlement. So Norfolk Island, like Australia and the U.S., is celebrating a Bicentennial. It has been 200 years of ups and downs, booms and busts, but the people here today are proud to see their flag as a symbol of a tiny island which has emerged as a modern, largely self-supporting and economically independent community of the 1980s.

73 AMATEUR RADIO

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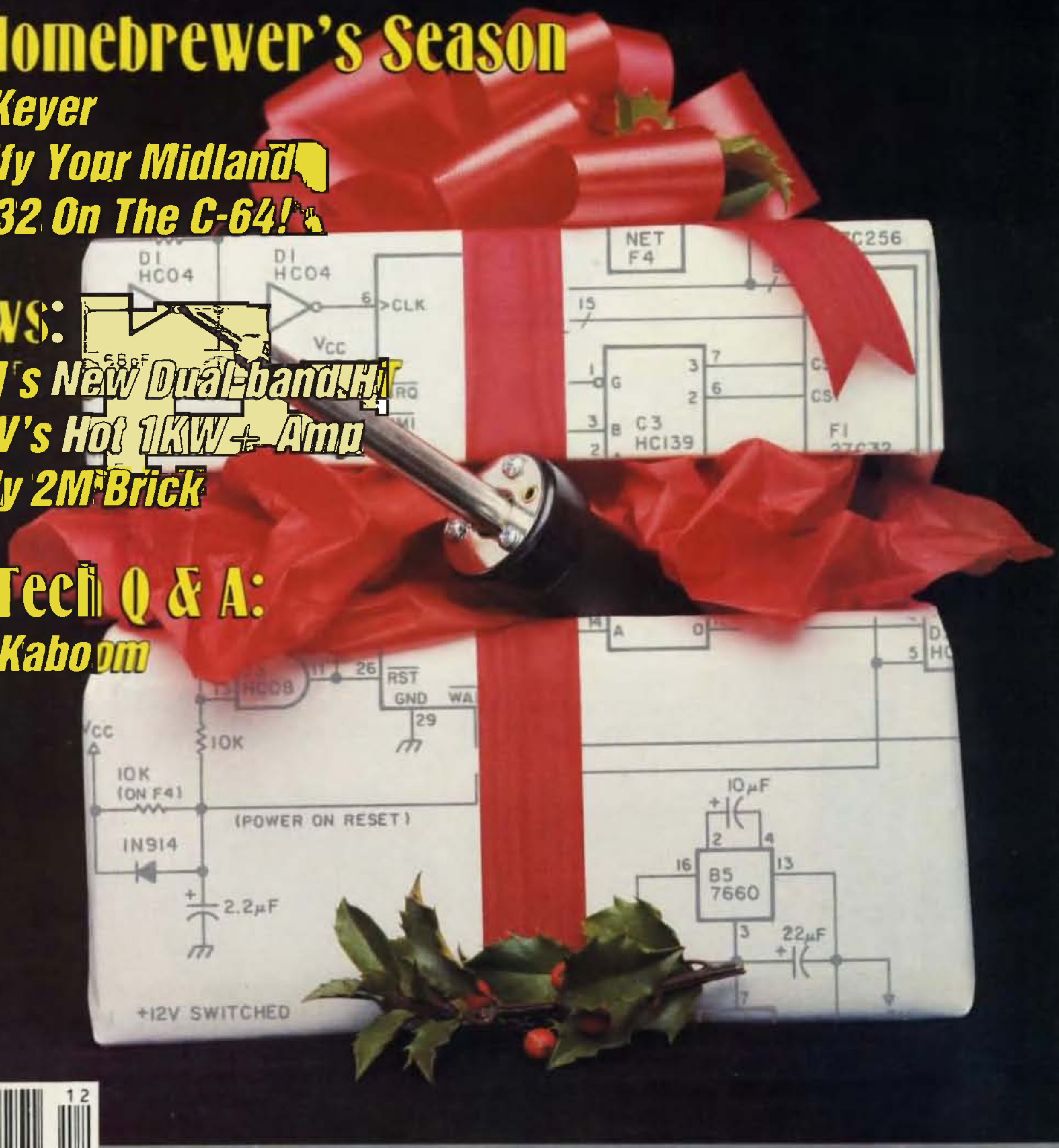

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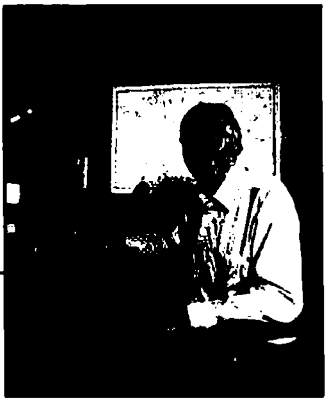

NEVER SAY DIE

Wayne Green W2NSD/1

Sun Spots and Antennas

Even though antennas are by far the most interesting area for amateur experimentation—and also one of the easiest to investigate, the field has seen pathetically little development in recent years. Tsk!

With the sun spots rising at the fastest rate in history, it's getting time for all of us to start working on antennas. How much do you know about 'em? Have you ever read an article on how they work? Do you have even a faint idea of how they work? Do you give a damn?

What do you know about bi-squares, cubical quads, the Twin Three and the ZL-Special? I remember when I first ran up against a bi-square. Sam Harris W8UKS, out near Cleveland, had put up a whopping tower and hung a 75m bi-square from it. To change its direction he'd run out and move the pegs holding the antenna away from his tower. How'd it work?

Well, this was 1951, so he was running an old 40 watt Collins AM rig. I was in Brooklyn with my rock-crushing kilowatt and a dipole. I worked out pretty well, working all over Europe, down into Africa and even over to Japan. Sam, with his lousy 40 watts, clobbered me. He'd be talking with a ZS6. I'd break in and the ZS6 would mention that he'd heard a slight heterodyne in the background. So they'd stand by to see who was breaking in. Drat!

When's the last time you saw an article on building a bi-square? And why it puts out such a whopping signal? If you want a killer contest antenna . . .?

In the middle of the rugged winter of 1947 I decided to try the W8JK Twin-Three antenna. Two dipoles spaced a sixth wave apart. For some reason this beaut has a lower angle of radiation than dipoles, yagis or quads. The result was that I'd have the first signal from my area. I'd call CQ and get calls from England saying I was the only signal on the band. Then, as they'd hear other signals getting stronger, mine would fade down and I'd talk with Italy. A little later I'd be the first signal into the middle east—then into India.

One morning I heard a very faint W7 portable something in the DX part of the band calling CQ. Hmmm. I called the "W7 something, portable something." I felt so stupid I only called him once. He came right back, his signal gradually improving. It was W7IMW/C7 in Tsiensin, China! I was the only American signal on the band.

We talked for a while, then he mentioned that other stations were beginning to call him, so we parted. An hour later he called again to say that everyone else had faded out.

The ZL-Special antenna is very similar to the Twin-Three, but made entirely from twin-lead. Have you used either of these barn-burners? They only seem to work well during high sun spot times, when the ionosphere is so heavily ionized that these extremely low angle signals can propagate.

The Twin-Three is simple to make. It's a wire beam with two three-wire dipoles spaced a sixth wave apart. You hang them from a pair of 2x2s, which, in turn, are hung by ropes between a couple trees or between a tall tree and your house. You feed 'em with quarter-wave 300Ω twin-line sections and feed the junction of the two feeders with 300Ω twin-line.

My question is this, how come you're not outside trying new antennas? Hells bells, it isn't as if you don't have a personal computer to do the calculations for you, an aid we didn't have forty years ago. Let's see some experimenting and some antenna articles!

How about a 40m Twin-Three? Maybe even one for 80m? How about stacked Twin-Threes? What's the radiation pattern from something like that? How about some club projects to test out different antennas?

Continued on page 6

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRM

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DECEMBER 1988 — Issue # 339

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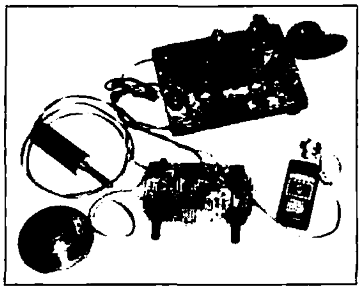


DEPARTMENTS

Photography by Suzanne Torsheya

Never Say Die

Continued from page 4

A few years back I visited the Hustler antenna range out in eastern Ohio—a ham's paradise! They even had a platform for cars so they could rotate a car on it and run a curve on the radiation pattern. That's something a club could do as a club project. Any takers?

I remember reading an article on the optimum height for 20m beams. It turned out that about 73' above the virtual ground gave the best DX pattern. Beat out even higher antennas. Come on, fellas, let's get going on antenna experimenting and get some articles into *73* so we can all have a ball as the sun spots open our bands. 20m will soon be providing DX contacts around the clock. 10m will be fantastic almost every day, giving Novices and Techies DX thrills. On 6m you'll be able to work all over the world with low power. Let's set some QRP records.

We're already seeing crazy sporadic-E openings on 6m. It's a hint when you tune your FM radio and hear strange FM stations pouring in by the zillions.

If you want to build a Twin-Three, dig back into a 1947 issue of *CQ* or an old Jones Radio Handbook and find the plans. Build one and let us know how you've made out.

Music on 20m—Legally

Yes, of course you can transmit music on 20m—or any other ham band. And, yes, if you do it right it's entirely legal. Would it help if I offered a prize for the first 20m ham transmission of The Blue Danube?

For that matter it's also legal to send fast scan TV over 20m—if you use the same system. Heck, you can send high definition 3D full color TV in the 20m phone band if you want.

So how do we send an Erich Kunzel and the Cincinnati Pops Orchestra playing The Blue Danube over 20m? Easy as pi. All it takes is some sneaky time shifting. You see, it's like this, that stuff on compact discs is digital data, not music. It isn't until we run it through a converter, deciphering the bit stream, that we get music.

The digital data on a CD is clocked at 44,100 Hz, so if you send it at full speed it's going to take up around 100 kHz of bandwidth, a bit much for 20m. It'd probably play on the UHF bands all okay. So okay, let's slow it down by a factor of twenty so it'll only tie up 5 kHz—like we do for slow scan TV, where we pare down a 5 MHz bandwidth and cram it into a 5 kHz slot.

A five minute musical selection would take a hundred minutes to transmit. Nobody said this was a fast system. we're aiming for sound perfection, not speed.

Slowing the bit stream down for transmission and then speeding it up again for playing is an obvious challenge. One fairly simple way of doing it would be to dump about 20 megabytes at a time from a CD onto a hard disk. You'd then program your computer to put it out at the slower speed into your rig. The receiver would do the opposite, loading the signal onto a hard disk and from there to a DAT recorder. Voila: The Danube floweth.

I've got $100 each for the first pair of you who pull this off. . . and prove it.

What about the FCC? If you'll read the rules carefully you'll find nothing to prevent your experimenting in this way. However, if you ask a civil servant to put his pension on the line by providing you with an official okay to do this you are a nut case and should be demoted to a CBer. Just go ahead and do it and stop your confounded nit-picking.

Pappy Is SK

I first met Pappy K4PP (K4LAP/K8LAP) when I was working as an announcer/engineer for WSPB in Sarasota, Florida. 1950. Nice gig, where I put the station on the air in the morning, did some announcing, read news, did a morning disk jockey show and then laid around on the beautiful Gulf Coast beach in the afternoon, working on skin cancer and premature skin aging.

Bandel Linn, "Pappy," did an afternoon talk show, so we got to be good friends. He'd bring in well known writers such as his good friend McKinley Cantor and interview them. He and Cantor were always pulling practical jokes on each other. Like the time Cantor bought hundreds of old books for a quarter each and had a rubber stamp made with Pappy's address. Cantor left the books on store counters and in hotel rooms all over the country. There still being a few honest people in those days, these books would be returned to Pappy, often sent collect. Hundreds.

Pappy was also an ace cartoonist. When I started *73* in 1960 I got him to do my first cover. Down through the years I've published hundreds of his cartoons for you. The last time I saw him, we got together while I was down in Mobile attending my old submarine crew reunion. Smoking had broken his health, but not his spirit.

Not long after my visit he had a stroke that paralyzed his left side. He was still able to turn out more cartoons for *73*—then a second stroke ended that—and his hamming.

That's two old ham friends and *73* contributors gone in a couple months—Bill Hoisington K1CLL and Pappy. Since most of you are about my age, you're having the same thing happen to you—good old friends dying. In this case we've lost two hams who have done much to make amateur radio more fun for all of us.

> ***"What do you know about bi-squares, cubical quads, the Twin Three and the ZL-Special?"***

Digital Audio

At a recent ham club talk I asked the assembled how many had CD players. Bunch hands went up. Great! Then I asked how many were reading *Digital Audio* magazine. Darned few hands. Whoa!

The reason I started *Digital Audio* magazine four years ago was because I knew that a high percentage of the early CDs would be technical disasters. I was right. Heck, even now, four years later, we're finding that 17% of the new CDs being released are barfs. They're so bad that most people who buy them play them once and that's it. Some are simply awful performances. Some are terrible recordings. Would you believe that you could end up with a CD made from old 78 rpm records, complete with the lousy sound and needle scratch?

A recent survey of the field showed that the average CD buyer is spending about $670 a year on CDs, mostly to replace his old LP collection. That's $114 a year wasted. Worse, another 60% of the CDs coming out can best be termed mediocre. They're okay, but with modest performances or only fair sound. That's another $402 blown through a simple lack of research.

Now if you've got enough money so that you can afford to waste $516 a year by buying lousy or so-so CDs, fine. I'll tell you this, you won't find wealthy people throwing away their money like that. You get to be wealthy by taking care of your money, not wasting it. Yes, the solution to the problem is simple: subscribe to *Digital Audio* magazine—a crummy $20 a year. This is the only magazine devoted to reviewing CDs, so it isn't like you have to buy a half dozen new magazines to keep track of the field.

In *DA*, as in *73*, I have an in-depth index to each issue so you can find the composer, performer, music or label of your particular interest. *DA*, like *73*, is fun to read. My *DA* editors don't take themselves any more seriously than the *73* editors. Try it, you'll like it.

If you haven't gotten a CD player yet you'll want to read the player reviews in *DA*. Compact discs are killing LPs, slowly, but surely. I stopped by the Sound Warehouse in Houston recently and found their sales were running 78% CD, 2.6% LP and the rest cassettes. The down side of CDs is that their sound is so fantastic that you'll be wanting to improve your hifi system in order to hear that wonderful sound better. If you're short of money you can make do with some Koss headphones, that will knock your sox off with the sound they let you hear.

Call my operator at 800-722-7785 with your credit card number and get started with *DA*. It's four years old now and has over 100,000 delighted readers. In fact, according to the Audit Bureau, it's one of the fastest growing magazines in the country. Or you can send $19.97 to *Digital Audio*, Peterborough NH 03458-1194.

And yes, you're in for another Wayne Green editorial every month. ■

QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Space Operations

AO-13 operations continue normally. On 19 September, a new schedule reflects the spacecraft attitude change.

The first Mode S transponder tests were successfully performed beginning at about 2025 UTC, 17 September. Three stations were on during the first test run—VE4MA, WB5LUA, and K0RZ. Mode S uses an uplink at 435 MHz and produces a downlink at 2.4 GHz. All three stations on the initial test ran SSB. K0RZ says the measured uplink bandwidth was 35 kHz; the measured downlink, 34 kHz. More than a dozen stations around the world reported hearing the 2.4 GHz beacon. Recent reports suggest good to excellent results may be obtained from very modest antennas. DF5DP used only a 20 dB gain yagi.

AMSAT-DL and AMSAT-NA thanks all those who submitted telemetry reports on the Mode L AGC levels. They have now established an automated system on AO-13 for logging AGC levels.

AO-10 is out of service for an indeterminate period due to poor sun angles. Recently, its beacon has been occasionally heard sending garbled PSK telemetry. This indicates the spacecraft IHU is powering down during eclipses and, when re-powered, logic circuits assume an indeterminate state. Occasionally the PSK beacon will be commanded by a chance logic state.

RS-11 will be operating Tuesday through Friday on Mode KA and weekends on Mode A. There is currently no RS-10 operation.

The new Mode S test window will be announced. Mode S beacon will run concurrent with Mode L but, for power budget reasons, will cause Mode J to be turned off during Mode S beacon operations. On or about 19 September, the attitude will be changed to BLON=210 and BLAT= +5 to respond to seasonal sun angle changes.

Canada

A new Radio Communications bill was brought to the table in the House of Commons by the Hon. Flora MacDonald, Minister of Communications. This is the first proposed major revision to Canadian communications law since 1938. If passed, it will permit the Canadian Government to stop the importation, manufacture, and sale of substandard radio equipment, and also permit the government to deal with electromagnetic interference problems by setting EMI susceptibility standards.

Scotland

Packet digipeating has come to Scotland. A packet radio digipeater (switch) became operational in central Scotland on 27 August. It operates on 144.650. Address reception and verification reports to GM1VBE.

Guinea Biseau

Dave Heil J52US finally obtained 6 meter operating privileges in this tiny nation on the western tip of the African continent, located 12 degrees north of the equator. Dave (US: K8MN) works for the US State Department.

To get this truly rare locale on the air, several members of the Midwest VHF/UHF Society are working toward finding a 50 MHz transceiver to loan to Dave, and welcome any donations. Equipment sought includes a Yaesu 620B transceiver, amplifier, and memory keyer. Contact the Midwest VHF/UHF Society, c/o Terry Netzley W8NJR, 1821 E. Troy Urbana Rd., Troy OH 45373.

$$ HOME-BREW IV $$

73 Magazine again invites all home-brewers to turn their hot solder into cold cash, and to get their name in print to boot. All project have a chance to appear in the magazine, and we will handsomely reward the authors of the *creme de la creme* of these.

First prize is $300 *plus* a ten-year subscription to *73*. Second prize is $150. Third prize is $75. This is in addition to the payment every author receives for publishing in *73*.

Contest Rules

1. Entries must be received by 1 April 1989.
2. To enter, write an article describing your best home-brew construction project and submit it to *73*. If you've never written for *73*, send an SASE for a copy of our Writer's Guide, or download them from CompuServe (Hamnet forum, Library 9., filename "73WRIT").
3. Here's the real challenge: The total cost of your project must cost under $73, even if all the parts were bought new. Be sure to include a detailed parts list with prices and sources.
4. Our technical staff will evaluate each project on the basis of originality, usefulness, reproducibility, economy of design, and clarity of presentation. The decision of the judges is final.
5. All projects must be original. That is, they must not be published elsewhere. There is no limit to the number of projects you may enter.
6. All purchased articles become the property of *73 Magazine*.
7. Mail your entries to:

73 Magazine
WGE Center
70 Rte. 202 N
Peterborough, NH 03458-1194
Attn: Home-Brew IV

Reciprocal Agreements

The FCC announced that three more countries—Antigua and Barbuda, Dominica, and Hong Kong—signed reciprocal licensing agreements with the US.

Never Too Old

Murl Fox KB6YPF is one man who apparently has never heard the adage about "teaching an old dog new tricks." Murl received his Technician class call only three months after celebrating his 97th birthday!

Hams at the Scene

Amateurs were among the first to arrive at the scene of the August 31st crash of Delta Flight 1141. The aircraft, a Boeing 727, crashed at takeoff. Immediately after the plane went down, both Dallas and Tarrant County RACES activated their "Mass Casualty Plan" mode. Under the Mass Casualty Plan, amateurs were dispatched to the crash scene and to all area hospitals to provide tactical backup communications. Virtually all the amateur radio communications between the hospitals, where survivors were taken, were on the 220 MHz band.

Some of the key operators were Art Hunstable N5KSA who served as Net Control Station for Dallas RACES, Ken Winters N5AUX who was one of the first hams at the crash scene, and Jim Haynie WB5JBP who manned the City of Dallas Emergency Operations Center.

There were 94 survivors and 13 fatalities in the crash.

87-139 Extension

Hams have been granted an 90-day extension to the commentary cutoff date on PR Docket 88-139. This rule-making seeks to streamline the rules governing the Amateur Radio Service. The new cutoff date was changed to 29 November. This came about as a result of many hams' concern about a part of the rewrite proposal which would give the Com-

QRX . . .

mission sweeping authority to restrict a ham from operating if his station caused any RFI. If passed as written, there would no longer be a system of checks and balances of FCC personnel handling RFI complaints. They could simply order hams off the air without appeal recourse.

Dead Sputniks

Leonid Labutin of Moscow, a prime mover in the Soviet Radio Sputnik (RS) program, reports that on 15 July, the first Western amateur visited the USSR RS command station RS3A in Moscow. Danny Kohn SM0NBJ of AMSAT-SM, visited UA3CR during his recent stay in Moscow. Danny interviewed the chief operator there, Leo Makhakov RA3AT, made tape recordings, and took pictures.

Danny will likely make an extensive report on his visit to RS3A after returning to Stockholm. Perhaps the most interesting news he learned was that, according to the operators at RS3A, RS-5 and RS-7 are now definitely out of operation. RS3A gradually lost control over these last two active RS satellites of the RS-3 to RS-8 series. They are convinced that the batteries in RS-5 and RS-7 are dead and so expect no new activity from them. RS-3 through RS-8 were launched together on 17 December 1981.

Amateur Radar?

Nick Leggett N3NL continues his campaign with the FCC to obtain permission for amateurs to experiment with radar. He has now asked the FCC to modify Part 97 of the rules so that all RACES radio stations and all commercially built amateur equipment be protected from Electromagnetic Pulse (EMP). Leggett claims that, to date, only a few selected military systems are shielded from EMP. He claims communications equipment can be protected from EMP by conductive shielding and active bypass devices. He asks that Part 97.4 require that all amateur stations manufactured or sold after 1 January 1990 be so protected.

Japanese T-Hunting

T-hunting is quickly gaining popularity in Japan. Last year, the first National Amateur Radio Direction Finding (ARDF) Competition was held in November 1987, with amateurs from the People's Republic of China (CRSA) and the Republic of Korea (KARL) participating. ARDF, which was introduced to Japan from Europe, is attracting the interest of many Japanese hams. ARDF events have already been held in various locations throughout Japan under the auspices of JARL branches and JARL-affiliated clubs.

88 and 73

The numerals 88 and 73 have been a tradition in communication languages for almost 130 years. The older of the two, 73, appeared in 1853 meaning "My love to you." In 1857, the first official definition made it a "fraternal greeting between operators." Two years later, in 1859, Western Union made 73 a part of their "92 code" to indicate "Accept my compliments." The final change came in 1895, when 73 meant "Best Regards" for the telegraph, and later for radio, operators.

88 never received the formality of an official listing until it was adopted as one of the ham abbreviations. It had been one of the telegrapher operator's traditional terms since well before the turn of the century. During the First World War, 88 was used by the U.S. Army Signal Corps, again strictly as an operator's abbreviation in unofficial communications. But at the close of the First World War, 88 achieved official status as part of amateur radio terminology, "Love & Kisses."

Not-So-Secret Service

Ever wanted to listen in on the men in shades during a presidential visit? It's easier than you may think!

Most frequencies used by the Secret Service/presidential protection agents are in the UHF range, and most of the transmissions are unscrambled voice narrowband FM. It appears that as many agents use plain English, as those who use code and ciphers. The secret service has also been known to use portable repeaters. Frequencies used in the past (either repeater output or simplex):

Air Force One/Two in the air—171.235 MHz
Air Force One/Two on the ground—171.285 MHz
Presidential Limo—164.885 MHz
Secret Service agents—165.375/.685/.785, 166.700, 167.025, 169.625/.925, 171.235/.285 MHz

France On 6 Meters

France has authorized its amateurs the use of the 50–51 MHz band on a permanent basis. The band will be available only to amateurs living more than 100 miles from a television transmitter. Three watts ERP at a distance of 150 km from a channel 2 transmitter is permitted. . .extending to 10W at a distance of 200 km. For channels 3 and 4, the protection zone is the signal coverage area of the television station. CW, SSB, RTTY, and packet are authorized to fixed stations only.

Repeaters in China

Members of the Boeing (Seattle) Aircraft ARC were in China demonstrating FM, repeaters, and interlinking systems on the amateur 2 meter and 1¼ meter bands. According to Yaesu USA Vice President of Marketing C.H. "Chip" Margelli K7JA, the Seattle amateurs took with them repeaters from ICOM and Spectrum Communications, antennas from Larsen, and a number of Yaesu handhelds that are being used to demonstrate all aspects of VHF-FM operation, including autopatching. They also took along packet radio gear from Advanced Electronic Applications, and various peripherals supplied by a long list of manufacturers.

The demonstration was a joint effort of the amateurs from Boeing working with the Amateur Radio Manufacturers and Publishers Association.

Navy Testing at Va Capes

If you live near the Virginia Capes or will be on a boat near there, be sure to listen to the maritime notices about the Navy testing going on in that region. The Navy is simulating nuclear blasts to learn about its effect on radio equipment. Make sure your gear is well shielded!

NBC Hams

Hams who are current or former employees of the National Broadcasting Company can keep track of one another over the 20 meter NBC Retirees Net. Hosted by Tony Rokosz W5RFO, the net meets daily at 10 AM Eastern time on 14.242 MHz. Rokosz, a former NBC Maintenance Supervisor, runs the conclave from his home in Rio Rancho Estates, just north of Albuquerque, New Mexico. For more information on the net, write Tony at: 1523 Sara Rd., Rio Rancho, New Mexico 87124, or call him at (505) 892-8308.

A Hearty Thanks

. . .to the cast of thousands who helped supply this month's QRX items. Among them are: *Westlink, ASR, FSAARC Newsletter, TSRAC B-N-T, QRZ Newsletter, CAREN's World, BirmingHam, JARL News, WorldRadio, Great Falls AARC Newsletter, Mike & Key, NABET News*, CARF, W7OIO, and GB2RS.

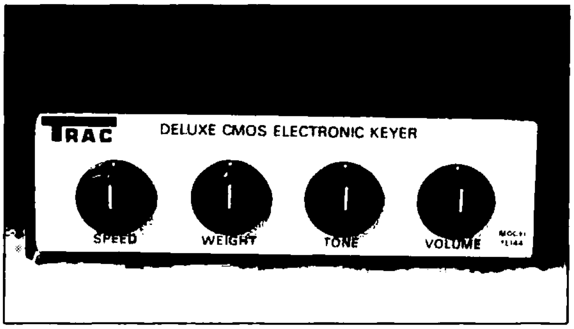
 by Jennifer Roe WA6OHX

Number 3 on your Feedback card

The TE-144 Deluxe CMOS Keyer

TRAC Electronics, Inc.
PO Box 7685
Charlottesville VA 22906
PH: (804) 973-3669
Price Class: $76

TRAC down this good value keyer.



The TE-144 is a deluxe CMOS electronic keyer from TRAC Electronics, Inc. There are six different models of keyers that TRAC manufactures, of which the TE-144 is the middle-of-the-line. It offers dot and dash memory, sidetone, a tune function, and speed (5–50 WPM) and weight controls.

Dot and dash memory only remembers that a dot/dash is sent in a specific order and outputs it in the proper order, (if the operator gets ahead of the output). This memory assures accurate output, but can't be recalled or programmed. The sidetone feature includes a tone and volume control. Sidetone capability permits the keyer to be used as a practice code oscillator. If sidetone is not required, TRAC suggests turning the volume to minimum to prolong battery life. The weight control allows you to add a distinction, or thickness, to the dot and dash for different operating conditions.

> *"The sidetone has tone and volume control."*

The input and output are ¼" jacks. In the TE-144, the tip of the plug is common, a somewhat unusual configuration. The schematic and instructions do not specify which connector is for the dot and dash, which requires a little detective work.

To tune, put the SEMI-AUTO/AUTO switch (positioned in the back of the box), in the SEMI-AUTO position. This is somewhat awkward if the back side of the box is not easily accessible in the shack. The only other adjustment on the back is the POS/NEG (grid block) switch. Unless there are other changes in the shack, it only needs to be adjusted at installation.

Circuit Workings

The CMOS circuitry allows the TE-144 to draw low current from the battery, thus eliminating the need for an on/off switch. A single 9 volt battery will last one year under normal operation.

The circuit is described as follows: A clock oscillator establishes the basic speed of the dots or dashes selected by the paddle-controlling IC. A clock division in another IC establishes precision timing control of the dots' intra-character spacing and the dashes. A third IC with its weight control, allows some "stretching" of the dots and dashes as desired by the operator. This weight-modified code gates on the audio oscillator, whose tone (frequency) is operator-variable with the TONE control. This audio version of the code is brought to a suitable output level by a transistor amplifier using VOLUME to control the level. A fourth IC, in addition to gating on the audio oscillator (sidetone), controls the transistor switch MPSA92 and MPSA42, which provides contact-to-ground output for one SW (POS/NEG grid block switch) position and a positive output voltage for the other SW position (for the requirements of the transmitter to be operated).

All the chips are on sockets and solid wire is used for all interconnects. The unit is housed in a heavy aluminum box with "feet" on the bottom to prevent marring. (I recommend scraping some paint away from where the cases connect (at the screws) to improve the bonding.) The integrated circuits (ICs) are easily available at most electronics stores.

With the TRAC TE-144 connected between my Bencher Paddle and IC-430S, the keyer functions well and reliably. The TRAC TE-144 is competitively priced and is a good looking, good operating piece of equipment. ■

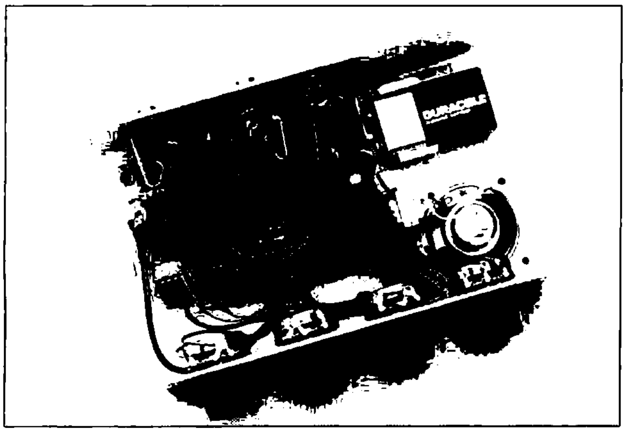


Photo A. Internal view of the TRAC TE-144.

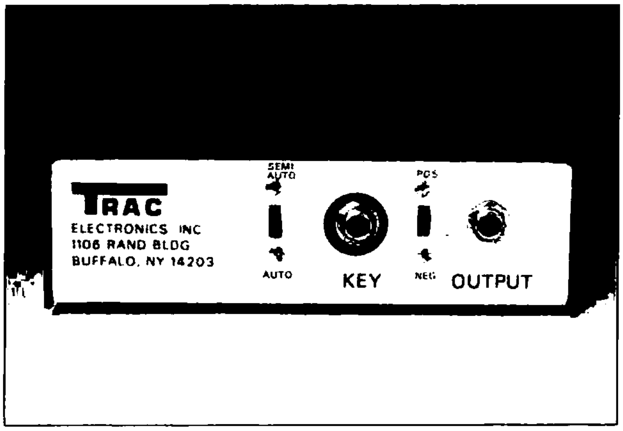


Photo B. The back panel showing the positions of the switches.

CIVIL AIR PATROL

Best kept secret in the world.

by Phil Nowak KA9KAF

What kind of radio operator's license can you obtain without having to wade through either code or theory? CB is such a license—but it lets you operate only on a few channels, and with very limited power. Yet there is a license that allows considerably more scope—one hundred and fifty watts on 26.620 MHz, operation on HF and VHF subspectra, and operation in a number of modes, including voice and RTTY. Much ham gear nowadays is easily convertible to frequencies in this Service. Licensing starts at fourteen years old. If you're lucky, you might even get a couple of weeks of an all-expense-paid vacation in a foreign land.

Photo A. One of the many activities of CAP. Mitch Hall "Red Fox 271" copying traffic.

No, I'm not suffering from code-induced delusions. This service actually exists, and quite naturally, thrives. It is the Civil Air Patrol, the US Air Force Auxiliary. CAP has over seventy thousand members, many of them cadets under the age of eighteen. Senior members are generally twenty-one and older.

The Waukegan Civil Air Patrol squadron is an outstanding example of what can be done to interest young people in amateur radio. Based at the local airport, the Waukegan squadron boasts its own communications building equipped with a complete radio room. A CAP group consists of several squadrons. Lieutenant Colonel Leonard Bromstead WB9MTC is the communications officer for both the squadron and Group Twenty-Two. Col. Bromstead, a CAP member since 1952, was chosen CAP Communicator of the Year for 1986. He has been the "Elmer" for dozens of young people in his area and conducts ham classes in his home. Over thirty people have become amateurs as a result of these classes.

CAP Hams

Ted Mathis N9HJN is a sixteen year old ham. "I was interested in radio as a small boy. After I joined CAP, Col. Bromstead encouraged my interest in communications." Ted is the only licensed amateur in a high school of 5000 students. When he carries his handie talkie to school, other kids think it's some kind of CB. He notes that "Most school kids have never heard of ham radio." Ted, who has recently upgraded to Technician, remembers what launched him into this fascinating hobby: "I wouldn't be in ham radio had it not been for CAP."

> **"CAP has over seventy thousand members."**

Mitch Hall age fifteen, who holds the CAP call "Red Fox 271," also recently entered the ham ranks as a Novice licensee. He concurs with Ted: "I wouldn't have even thought of a ham license without CAP." Mitch has also had a wonderful time with CAP, and really appreciates the hands-on practice. Asked if there was a ham club in his school, he answered with depressing predictibility: "No, and most of the kids have never heard of amateur radio."

Best Way to Go

Why is amateur radio activity in schools on the wane? For one, it's very hard to get teachers to run ham clubs. Len WB9MTC feels that the main reason, however, is that ham clubs don't offer enough initial excitement for young people. In a CAP program, cadets often ride on Air Force aircraft, such as the C-130 Hercules. They take camping and hiking trips. Cadets visit Air Force bases (Wright-Patterson AFB in Dayton, Ohio, and Strategic Air Command at Offut AFB, for cadets from the Chicago area). CAP has three primary purposes: aerospace education, emergency services, and the cadet program. Cadets participate in all three.

"Young people are introduced to radiocommunications, in the midst of all the excitement, and so they develop a good association with it," continues Len, "This helps them appreciate amateur radio that much more when they start getting involved with it."

Cadets are encouraged to study aerospace. They take periodic exams and are rewarded for good marks by promotion to higher rank. A cadet can progress all the way to cadet colonel.

The US Air Force sponsors several CAP search and rescue missions each year. Group Twenty-Two cadets are capable of handling most of the communications workload of a mission, both in the radio shack and out on the flight line. They talk to pilots, flying observers, and ground personnel. Pretty exciting stuff, especially on an actual mission.

Plenty of Incentive

A very nice feature of CAP is the international air cadet exchange program. Every summer, a few lucky cadets, along with senior member chaperons, spend two weeks visiting foreign countries—at government

expense. The cadets chosen to go are the ones who are very active in their units.

Aviation is a big drawing card. Angela Greanias "Red Fox 311," a fifteen year old female cadet, joined CAP to enter a flight training program at reduced cost. She stresses, "CAP doesn't have to lead to a military career. I personally have no desire to join the military, but that doesn't keep me from having a lot of fun with CAP." Angela is the Cadet Personnel Officer for the squadron. Angela's made many new friends in CAP, and she feels it's developed her leadership abilities. Angela operates a Regency VHF crystal-controlled radio for her CAP communications. She's now studying for her ham ticket to broaden her communications horizon.

RDF Activities

What bearing does CAP have on foxhunting? Plenty! There are many simulated downed aircraft searches. In the Waukegon group, Col. Bromstead conducts ELT (Emergency Locator Transponder) search exercises. An ELT is an automatic on-board transmitter used to locate downed aircraft. A radio operator at a base station directs cadets in a car to a target location. A senior member drives the car and follows the directions of the lead cadet. When they reach the target, they identify it. The next cadet in the car gets to be the lead cadet, and they search for another target. Everyone gets a turn.

Photo B. Several cadets getting the low-down on a Canadair Challenger from the co-pilot, Charlie Tennstedt.

". . . most of the kids have never heard of amateur radio."

Cadets also participate in actual ELT searches. A ground team goes into action looking for the target. Ninety-seven percent of the time it is a false alarm—but they often save lives in the remaining 3 percent of true alarms.

Opportunity and Fun with a Structure

Cadet squadrons meet once a week. This provides an ongoing structure for both cadet and senior members. When someone like Col. Bromstead takes an active role in recruiting, motivating, and training young communicators, it is inevitable that the ham community benefits.

Kids aren't the only ones becoming hams, either. Carol Szarfinski KA9PRE is a captain in CAP. She is a senior member and a graduate of Col. Bromstead's ham class. She told me, "I heard about the week long CAP communications school held annually by the Great Lakes Region. I joined CAP to go to that school." Her husband, Mike KA9ATL, and her father W0NSW, are pleased at the new hams. Now, as Red Fox 277, she conducts the Tuesday night CAP northern Illinois VHF net. She can now keep in touch via ham radio with her father, Milo W0NSW, in Kansas.

Indeed, CAP and amateur radio activities often support each other. For example, the Waukegan squadron runs an annual hamfest. "It has been profitable every year we have held it. The proceeds go to fund squadron activities thoughout the year."

Photo C. Col. Bromstead, flanked by Angela and Veronica, holding his "Communicator of the Year" trophy.

CAP Lingo

While there is a lot of emphasis on hands-on training, formal communications procedures are also taught. The student learns the use of prowords. These are words with specific meanings that communicators recognize, such as "Over," "Roger," and "Out." The CAP radio operator takes an exam on communications and operational procedures at the end of the class. If he passes, he receives a Radio Operators Permit. This allows him to talk on any CAP radio with all the privileges mentioned earlier.

Just the Beginning

The Civil Air Patrol offers many exciting activities for teenagers and adults alike. Communications is an integral part of the entire process. While it is much easier to get an ROP card than it is to get a ham license, there are just a few frequencies that you can use. Your audience is also quite limited. Rag-chewing is not encouraged, since these are military frequencies. Once CAP radio operators gain some experience using the radio, they often want to talk to more people on more frequencies.

Get Involved!

Sound appealing? Look up CAP in your telephone directory. Can't find it there? Send a postcard to *HQ CAP-USAF/PA, Maxwell AFB, AL 36112-5572; ATTN: Tsgt. Scott* and ask them to put you in contact with the unit nearest you. Too impatient to wait for the mail? Call *205-293-5463* and ask the same question. Tell them you read about it in *73* magazine. Break and end. This is Red Fox 197, out. 73

RS-232 Port For The C-64

Allows easy file transfer to and from the C-64.

by Ralph Neal

There were many text files on my old C-64 computer I really wanted to transfer to my Amiga. Unfortunately, this wasn't easy to do. I transferred the first files by uploading them to a local BBS, and then downloading them with my Amiga. This works, but it is time consuming, and requires two modems, one each for the C-64 and the other computer.

For the Amiga, it is more convenient to use a program that allows the computer to read C-64 files. However, the disadvantage is that to use the program, you must have a 5¼" disk drive attached to your Amiga, not a popular drive for the Amiga.

A third possibility, and the one I prefer, is to use a null modem. For most computers, this is simply an RS-232 cable running from one computer to the other via the serial ports. This will not work for the unmodified C-64 because it has no RS-232 serial ports. With a little work and time, however, you can build an RS-232 port for the C-64. But first, you need to know a little about how the RS-232 works.

A Little RS-232 History

Several years ago, an industrial committee agreed to a standard interface for serial transmissions. They agreed that −3 to −25 volts would represent a logic of 1, and +3 to +25 volts would represent a logic of Ø. While the C-64 is quite capable of sending and receiving serial transmissions, it does not do so at these voltage levels. The C-64 uses a TTL standard in which 1 is defined as a voltage between +2.4 to +5 volts, and Ø as a voltage between ground to about 0.8 volts. There are several ways to to make the TTL standard compatible with the RS-232. They range from discrete circuits composed of transistors, optical isolators, and the like, to ICs designed just for that purpose. In this article I chose the latter, using the MC1488 line driver and the MC1489 line receiver.

The Circuit

See Figure 1. This is a relatively simple arrangement, requiring only three ICs for its operation. However, the voltages needed to power the MC1488 line driver range from +15 volts DC to +7 volts DC on the positive side, and from −15 volts DC to −2.5 volts DC on the negative side. In fact, there are no usable voltages for the MC1488 line driver, plus or minus.

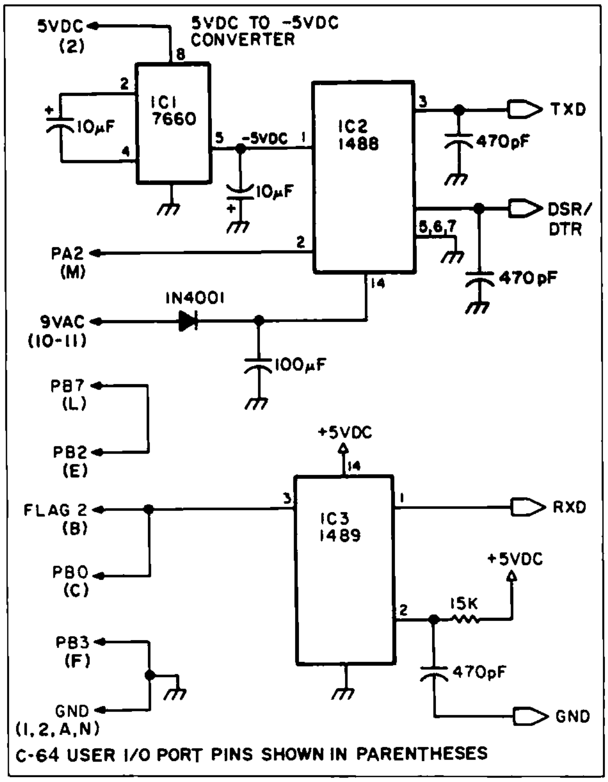


Figure 1. C-64 RS-232 port interface schematic.

It was not hard to generate the required voltages. I obtained the negative power with a special purpose IC, the 7660 voltage inverter. Using two 10µF capacitors, this IC takes +5 volts DC and converts them to −5 volts DC. The positive voltage was even simpler to obtain. While the user I/O has nothing greater than 5 volts DC, it does have a 9 volt AC source. With a diode and small filtering capacitor, I was able to half-wave rectify the 9 volts AC and obtain about 12 volts DC, well within the 7–15 volts needed.

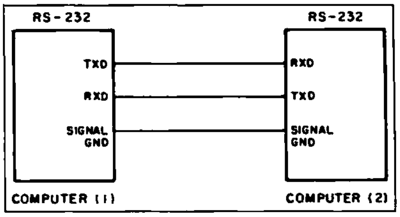


Figure 2. RS-232 cabling wiring.

When building this circuit, you will notice that only seven of the 14 pins are used on the MC1488 and five on the MC1489 ICs. Often it's a bad idea to leave your inputs dangling, as in TTL and CMOS logic, but in this case it does not seem to hurt. I have used this circuit several times now, with good data transfer each time.

Now refer to Figure 2. To use the RS-232 interface as a null modem, connect the TXD (transmit) pin to the RXD (receive) pin and the RXD pin to the TXD pin. You may need a third line, marked DSR/DTR (Data Set Ready/Data Terminal Ready), to inform the other computer that the C-64 is alive and ready. The fourth line from the RS-232 interface is attached to the signal ground from the other computer's RS-232 interface. Once the null modem cable is configured correctly, you will need to load terminal programs into both computers. Then you should be able to communicate from one computer to the other, as you would in communicating with a BBS.

In closing, I would like to point out that this circuit has other possible uses besides that of a null modem. It should be possible to connect RS-232 modems and printers to the C-64 using this interface. Perhaps someone reading this will be inspired to do so. Happy building! ■

User I/O Port

Pin	Type	Pin	Type
1	GND	A	GND
2	+5V	B	FLAG2
3	RESET	C	PBØ
4	CNT1	D	PB1
5	SP1	E	PB2
6	CNT2	F	PB3
7	SP2	H	PB4
8	PC2	J	PB5
9	SER.ATN IN	K	PB6
10	9 VAC	L	PB7
11	9 VAC	M	PA2
12	GND	N	GND

73 Review

by Allen Short WA9FPU

Home-Brew Fun!

Bel-Tek's CMOS keyer kit.

Bel-Tek
PO Box 125
Beloit, WI 53511
Price Class: $10
Add-on memory: $15

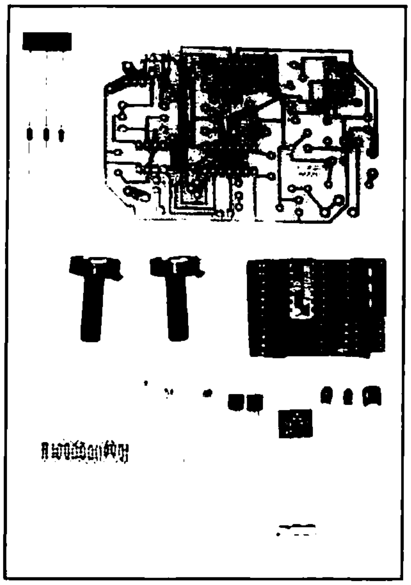


Photo A. The board and parts before assembly.

Are you a new Novice in need of your first keyer? Or perhaps an experienced Extra looking for a bargain in ham radio? I spotted an ad for the Bel-Tek CMOS keyer kit that described a unit that seemed to fit both bills, in the November 1987 issue of *73 Magazine*. It mentioned neat features such as a triggered clock to eliminate start delay, circuitry that automatically inserts a dot or a dash between tones, acceptance of any power voltage between five and 12 volts DC, accidental polarity reversal protection, operation between five and 50 WPM, adjustable 800 Hz sidetone volume, and compatibility with grid block, cathode keyed, and solid-state transmitters.

All this sounded pretty tempting. The low cost of the kit—$9.95—finally convinced me to give it a go.

First Look

The printed circuit board for the keyer was small (2.5" x 3.5"), and it could be placed into many low band transceivers, but I wanted to use it with several different rigs.

When I started the CMOS keyer, I wanted to see if the cost of the project could be kept low while still providing a nice piece of equipment when finished. As I looked through the well stocked junk box, I found the following parts: a speaker, a battery clip, a battery power lead, a switch, all of the hardware, the decal kit, and the paint. I had some extra boxes, but they weren't the right size for the project. So one night after work, I stopped at Radio Shack and bought the box shown in Photo C. It has a Radio Shack part number of 270-238, and it just fits the project.

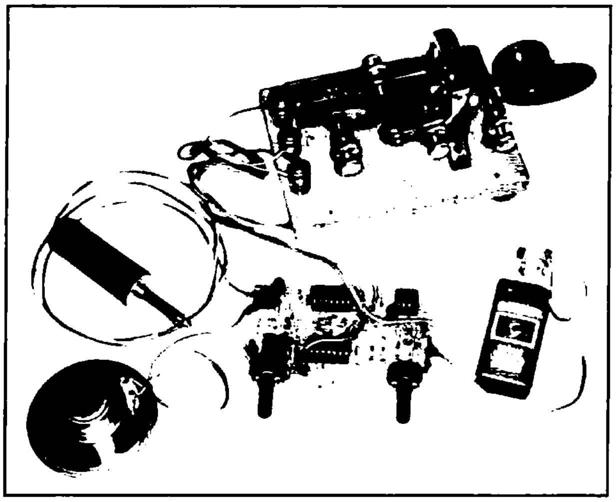


Photo B. Getting ready for the test run of the keyer.

Bel-Tek did a nice job on the kit for the money. They provided the board and the parts, with a set of instructions on building the board. To solder the board, I used a small iron to make the connections, but I didn't put in the CMOS chips until all solder connections were made. After building the board, I had a trial run to see if it worked. I have an old HW-16 CW transceiver that I used for the test. The keyer worked just fine. The only problem was that, when powering up the keyer, it would only send a single dash. I didn't find this to be a problem since I have heard other keyers do this same thing.

Final Touches

After the test run, I did get into another problem of my own doing. Some of my friends know me as a very conservative fellow, or just plain cheap. What happened is that I tried to use an old nine volt battery, and it wouldn't work. So I went out and bought a new nine volt battery just like the instructions sheet said to do.

Once all of this was brought under control, it was time to begin the final assembly. The box was made of soft aluminum, so I used my old drill press to do all of the drilling. I had a can of spray paint from K-Mart that had a Fanspray valve on it, to give a very nice finished paint job at a low cost. After the paint had set up, I baked the box in the oven for 10 minutes at 200 degrees. This gave a nice baked paint job on the box. The decals were cut out and placed on the box to complete the finishing touches.

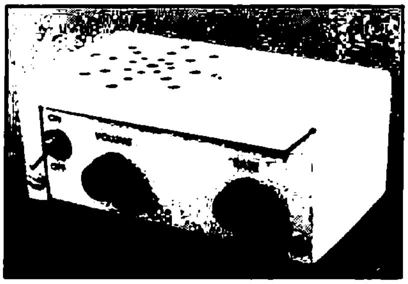


Photo C. The front of the finished project.

On the back of the box, I have two terminal strips, one for the transceiver, and the other for the key. The small jack is for external power for the power supply used as long as it is five to 12 volts DC, and of adequate current. I thought this would be a worthwhile addition, so that another type of power supply can be used other than the built-in battery. Have you ever been in a contest and had a battery die at a very late hour of the night?

The keyer is very easy to switch between grid block and cathode keying. Simply reverse the leads on the transceiver terminal strip. It doesn't need any modification to the equipment in the set-up.

The goal of the low cost keyer was achieved. The cost was as follows; the Bel-Tek kit $9.95 postage $1.50; the box $2.50; the battery $1. Total cost: $14.95.

In Sum

I think the keyer will give many years of service at low cost. It was a rewarding experience to build it and I would encourage the newcomers to amateur radio to give this project a try. It is a first homebrew type of project and from this, try something a little more difficult. I feel that this keyer is a good way to break into homebrew.

Number 7 on your Feedback card

Don't lose your memory!

End the backup battery problem in the ICOM IC-R71A receiver.

Bob Roehrig K9EUI

One of the most outstanding communications receivers on the market today is the ICOM IC-R71A. It has all the features you could want in a receiver, whether you are an SWLer, amateur, or commercial user.

The big drawback of this receiver is that the necessary information to its operation is stored in RAM, and it depends on the lithium backup battery to retain this information. If this data is lost, the radio simply will not work.

The lithium battery is supposed to be good for several years (I have heard that the expected life may be as long as 7 years). What if you were using this receiver, however, during a DXpedition, or during a contest, and suddenly the radio went dead? The manual says "Contact your dealer or ICOM service center." I learned that, for $25, ICOM will replace the battery and reprogram the board if you send it to them. I figured there had to be a better way, and indeed there is.

Some other ICOM models have the same RAM board, and so have the same problem. The ideas presented here will likely also apply to this equipment.

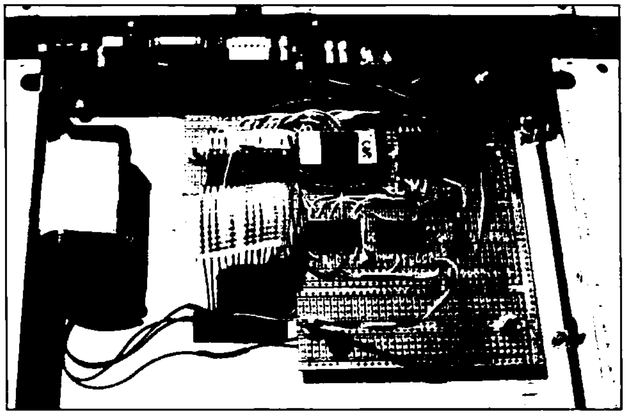


Photo A. The new board in K9EUI's receiver.

Choices

There are other options to handle the battery problem besides sending the board to ICOM. You could change the battery yourself before it goes dead. To replace the battery, simply remove the board from the receiver and power it from a 5 volt bench supply. You might consider changing over to a more standard type of battery, such as three AA alkaline penlight cells. As long as power is applied to the board, the batteries can be replaced without losing the memory.

To understand what is going on in the receiver, look at Figure 1, the schematic of the RAM board. There are apparently two versions of this board. The board layout drawing in my manual is different than the board in my receiver. One version uses an 18-pin RAM and the other uses a 24-pin device. The result is the same so it doesn't make any difference which one you have. (Figure 1 shows the 24-pin version.)

Power and addressing connect to the board via J1, and the data lines, write, and ground are on J2. Notice that only four data lines are used. When the receiver is turned on, the RAM IC is powered from the radio's 5 volt bus through diode D1. When the receiver is turned off, the RAM is kept alive by battery voltage through D2, and the chip select lead is held positive by R1. This disables the IC and puts it in a high impedance state. The current drain is almost not measurable in this state.

Also notice that address line 10 is not used but grounded. Thus, only half the available memory is used. Only the lower 256 memory positions contain the information that cannot be lost. The rest of the RAM holds the frequencies that are stored in memory, and the last frequencies (and modes) used by the two VFOs. When the lowest 256 addresses are being used, both A8 and A9 are low. The output of IC2-C remains high which inhibits writing to the RAM. If either A8 or A9 or both are high (above address 256) Q1 is turned on to permit writing to the RAM.

If the battery does go dead, you can reprogram the board yourself. Table 1 shows the listing of what is in the lower 256 bytes of memory. Figure 2 shows the circuit for a manual programmer. Switches S1 through S8 select the address, and S9 through S12 are the data switches. A simple adapter can be made using a piece of perf board and stiff wires to mate with J1 and J2. After the battery has been replaced and the board is connected to this programmer, apply power and close the PROG switch. Step through the addresses, one at a time, select the correct data for each address, and press the WRITE button.

RAM-Only to RAM and ROM

The best solution to the problem is to replace the present RAM board with a new board containing both RAM and ROM. The essential receiver information is put in an EPROM and the RAM is used just to store the memory/VFO information. So if the battery does go dead, you do not lose the operating data itself.

You can manually program the EPROM programmer with the data in Table 1 or you can build an adapter that allows the data to be

PROM Program

00:	0,	0,	F,	1,	F,	F,	1,	F,	F,	0,	0,	2,	F,	F,	F,	F
10:	0,	0,	0,	B,	5,	9,	6,	8,	6,	8,	0,	0,	0,	3,	2,	0
20:	0,	5,	9,	3,	0,	0,	0,	5,	0,	0,	0,	0,	0,	0,	0,	0
30:	0,	1,	0,	0,	0,	0,	0,	0,	3,	0,	0,	0,	3,	0,	0,	0
40:	1,	0,	0,	0,	0,	0,	0,	0,	3,	0,	0,	F,	F,	F,	F,	F

50 Through FF: Data is all "F"

Table 1.

read from your RAM board directly into the EPROM programmer. Figure 3 shows such an adapter. The adapter simulates a 2716 EPROM for read-only purposes. The highest four data bits are not used and are grounded so that zeros result. Even though the programmer expects 2048 bytes, we only need the lowest 256, and that is all the new 2716 EPROM is programmed with.

Figure 4 is the schematic for the new receiver board. J1-11 switches low when the board is addressed. When both A8 and A9 are low, the 2716 CS pin goes low to select the RAM. If A8 and/or A9 are high, pin 18 of the 6116 RAM switches low, enabling this IC. The data and address lines of IC1 and IC2 are paralleled. I used a Hitachi HMS-6116 for the RAM chip. This is an inexpensive device and the pinout is similar to the 2716 EPROM. While most of the 2716 is not used, this is a popular EPROM that most all programmers can handle. Other RAM and EPROMs can be used if desired.

There are devices available called NOVRAMs, that can be used in place of the 6116. These devices need no separate battery to retain their data. I don't know the life expectancy of them, but the idea is certainly attractive. There is a NOVRAM that is pin-for-pin compatible with the 6116.

Power for the 6116 RAM is obtained via D1 or D2, as on the original board. I used a pair of germanium diodes to minimize the voltage drop.

The second advantage of using this circuit in the R71 is that the number of memory channels can be doubled to 64. Since the highest address, A10, is not used by the receiver, only half the available storage is used. By switching A10 of the RAM high, we now have twice the storage capability. If you do not have the remote option board in your receiver, the remote switch on the front panel does nothing but light the remote LED. Pin 4 of J12 on the matrix board switches to approximately 13 volts when the remote switch is turned on. Connecting this pin to Q2 of the new board permits selecting another bank of 32 memory channels with the remote switch. When scanning, only one bank can be scanned at a time.

For a backup battery, I used a Radio Shack holder with three AA alkaline cells. The standby current of the 6116 is in the microampere region so the battery should last for some years. Do not forget to check for corrosion occasionally.

The photo shows the new board installed in my receiver. There is not room to install it in place of the original board, so it is mounted on a metal plate above the logic unit. I replaced the original plate with one of sheet metal about 1 inch longer. The old plate was used as a drill template for the four mounting holes and the scan rate control access hole. Slots for the connectors were cut in the plate with a nibbler tool. The cables for J1 and J2 have amp connector strips on the ends and were taken from a surplus computer board. The pins have 100 mil spacing and can be obtained from many supply houses specializing in computer accessories. My board is a lot larger than necessary but it allows for adding future modifications.

With this new board in your receiver, you no longer have to worry about your radio losing its essential operating data. The receiver itself is not modified in any way and can be restored to its original condition in minutes, if desired.

If you wish to build this board and need the programmed EPROM, contact me at 314 S. Harrison St., Batavia, IL 60510 and send a SASE for details.

Thanks to AJ9S and WA9FVP for their comments on the R71 and special thanks to W9DJN for the use of his PC/XT and EPROM programmer. ■

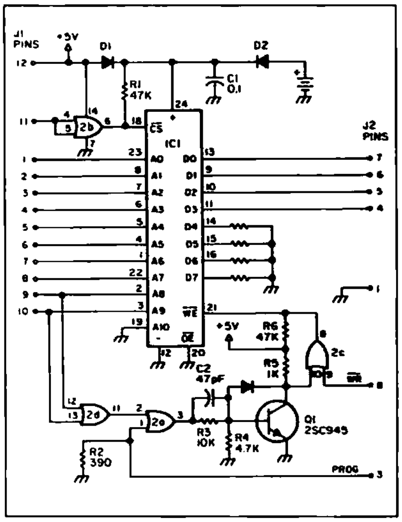


Figure 1. Schematic for the IC-R71A RAM board.

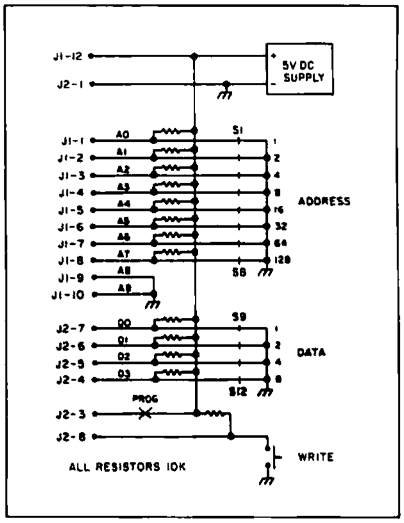


Figure 2. Manual programming setup.

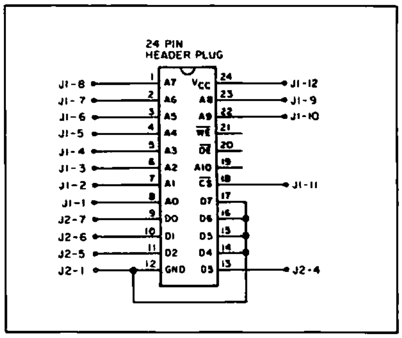


Figure 3. RAM board to 2716 EPROM read adapter.

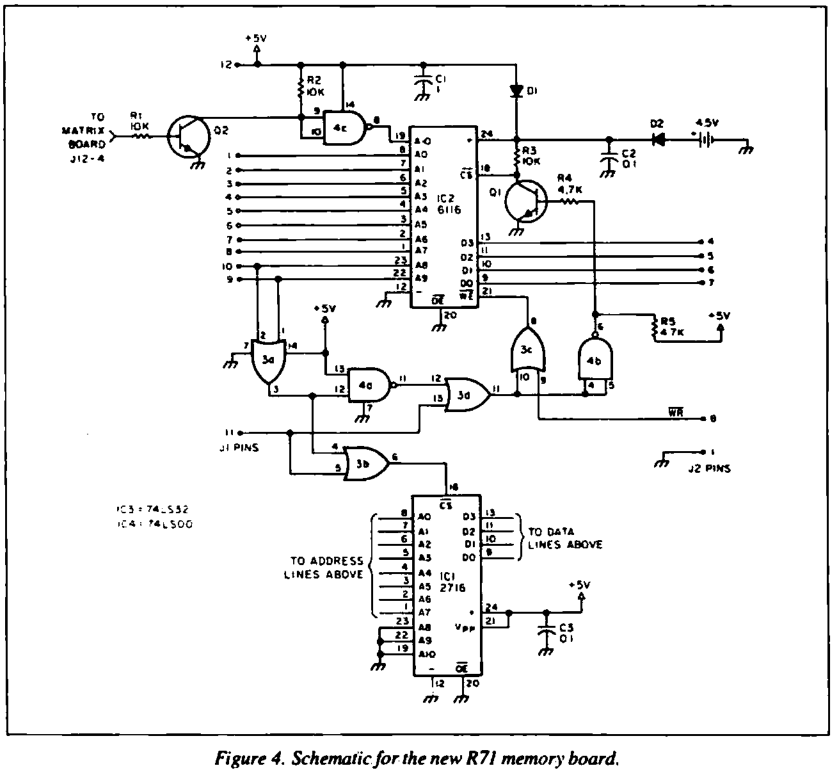


Figure 4. Schematic for the new R71 memory board.

Packet Tuning indicator

Dead-on HF packet tuning for $15.

by Ronald B. Koester W2EKY

Many packet stations, including this one, got their feet wet on the VHF bands, where tuning is just a matter of button-pushing. Sooner or later, the old DX bug bites and the temptation of HF DX operation arises. This is where the trouble begins: no buttons! Tuning in a packet station on the 20 meter band without a tuning indicator can be exceedingly aggravating because you must tune to the 2025 Hz and 2225 Hz modem frequencies directly. The slightest mistuning leads to no received packets on HF.

You can buy commercial tuning indicators for around $40, or build one for less than half that. The unit described here can be built for about $15, depending on what the old scrap box contains.

The Circuit

The circuit consists of two identical phase-lock loop (PLL) decoding ICs (see Figure 1). Decoding is a function of the timing components R1/C7 and R2/C8. The outputs of both IC1 and IC2 feed a resistor transistor NAND gate Q1.

R1 and R2 are 5kΩ 10-turn potentiometers. (I used 10kΩ in the original design due to availability, but they required more critical tuning.) Both pots should be preset to 3k across the unshorted portion before soldering.

The tuning indicator fits on a PC board measuring 2" x 3". Should you decide to use a different type of construction, you should find little difficulty at these low frequencies. You can house the completed unit in a plastic or metal box.

A few more construction hints: note the use of a jumper directly above R3, and use a shielded cable for signal input.

You can find all the parts you need at most Radio Shack stores. I listed below the parts by value and corresponding Radio Shack numbers.

Adjustment

This is best done using an audio signal generator and frequency counter, shown in Figure 2. Adjust the output of the generator to 2025 Hz as read on the counter. Adjust R1 on the decoder until the red LED 1 lights up. Keep reducing the level of the signal by adjusting control RA and repeated adjustments of R1. This adjustment is critical for proper performance. Repeat the same procedure with R2, but use a frequency of 2225 Hz for LED 2. There's a small amount of interaction between IC1 and IC2, so it pays to repeat both adjustments.

Lacking a signal generator and counter, you can tune the circuit by carefully adjusting your receiver until you are consistently receiving packets. Next, alternately adjust R1 and R2 until they light at the lowest possible volume level. In operation, the correct reception of a packet station will result in both LEDs flickering, and the corresponding lighting of the green LED 3. In normal operation, the red LEDs 1 and 2 are dimly lit in absence of a signal.

Have a spare fifteen bucks and an evening? You can go out an have a (modest) meal with a friend. Or—put together this project and enjoy worldwide packet with dead-on tuning! ■

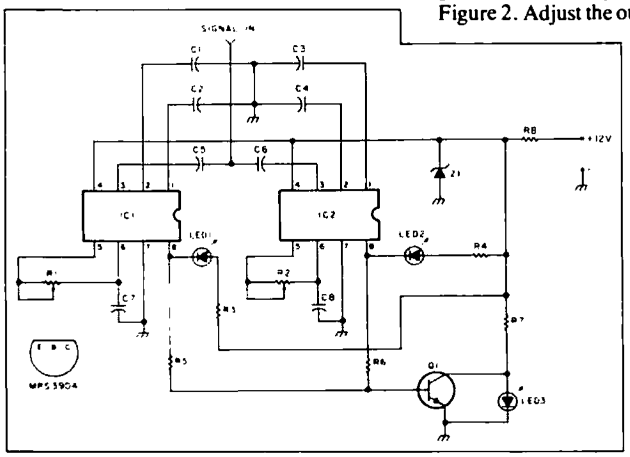


Figure 1. Schematic for the HF packet tuning indicator.

Parts List

Quantity	Part#	Value	Radio Shack#
2	C1-C4	1 µF, 35 V	272-1434B
2	C5-C6	4.7 µF, 35 V	272-1012
2	C7-C8	0.1 µF, 50 V	272-1069
2	R1-R2	5k 10-Turn Pot	271-343/10K Sub.
2	R3-R4	1k ¼ W	
2	R5-R6	47k ¼ W	271-1342
1	R7	560 Ω ¼ W	
1	R8	100 Ω ½ W	271-012
1	Q1	MPS 3904	276-2016
2	IC1-IC2	LM 567	276-1721
2	LED1-LED2	Red	276-026
1	LED3	Green	276-037
1	Z1	9.1 Zener	276-562

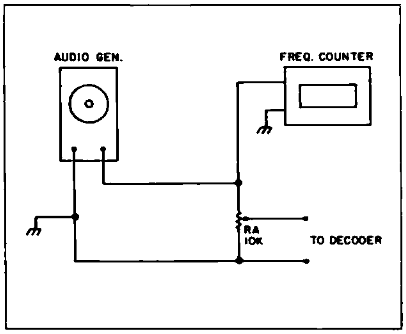


Figure 2. Alignment set-up for the tuning indicator.

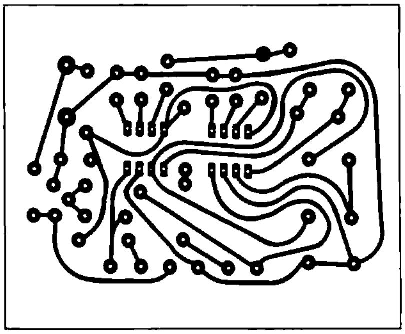


Figure 3. PC board foil diagram.

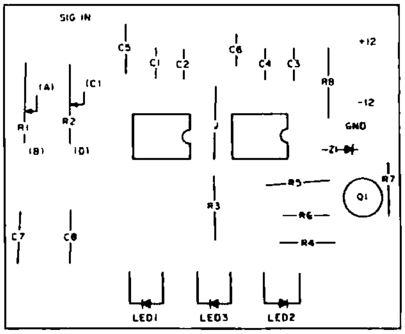


Figure 4. Parts placement diagram.

Midland 13-509 Modifications

A few fun and useful mods.

by Klaus Spies WB9YBM

Although the Midland 13-509 radio has not been in production for ten years, many still consider it *the* 220 radio because of its reliability and versatility. Even today, it's the rig of many repeater links. Therefore, it's inevitable that more modifications and improvements are becoming available for it. The type of transmit and receive boards used in the 509 are also used in similar radios, such as the Clegg.

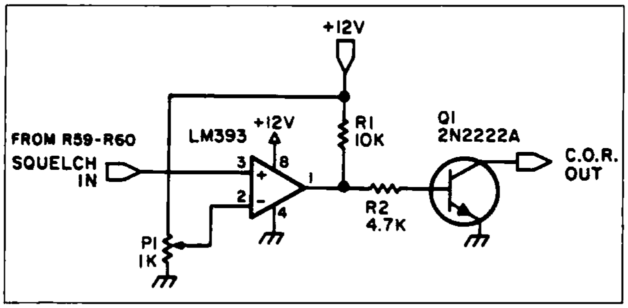


Figure 1. The high impedance load for the squelch circuit. This ensures no audio degradation when an additional signal (as for a COR function) comes from the squelch circuit.

Better Squelch Performance

The first circuit described here, the "High-Z COR," came about primarily because the squelch circuit in the 509 (R59-60 is the typical place where the signal is obtained) is rather sensitive. It is prone to making the squelch sound strange when loading occurs, even when the load is buffered by a 2N2222A transistor. What is therefore needed is a high impedance load for the squelch circuit, so that there will be no degradation in its performance when an additional signal (as for a COR function) comes from the squelch circuit.

There are two ways to bring a high impedance load to the squelch circuit. You can use a high-gain Darlington transistor with a large base resistor (wire the Darlington as a common-base switching amplifier), or use a component with a naturally high input impedance, such as a FET or an IC with a FET input. This way, the loading on the squelch would be light enough to not affect the performance of the squelch, while providing enough amplification and current capabilities to act as a COR. It is practical to use an IC rather than a FET. An IC, such as the LM393 comparator, has gates left over which you may want to use later for other circuits.

The squelch circuit of the 509 provides 2.5 to 2.65 volts when the squelch opens (either at a received signal, or when the squelch is manually opened by turning down the squelch potentiometer), and a few tenths of a volt when the squelch is closed. P1 is biased for approximately 1.5 volts. Even though the LM393's specifications claim it can operate within a few tenths of ground, it isn't always wise to operate an IC near its limit. It's wise to bias it up. A potentiometer makes setting the voltage easier. You don't have to calculate voltage dividers or experiment with resistor tolerances.

The output of the LM393 drives a transistor which can handle higher currents than the IC. I have used this circuit to actuate the REMOTE on/off function of a tape recorder for logging signals when the squelch opens in my 509, and it works flawlessly.

Are You Really TX?

The second circuit, the TX Light Control, developed through a two-stage modification. In the first modification, the 509's small transmit light bulb was replaced with an LED. In the second modification, I realized that the 509's transmit indicator (now an LED) went on whenever the PTT line was toggled into transmit, and not necessarily when the radio itself was transmitting. There is a difference between these two functions. When the relay used in the radio's T/R section becomes worn, the radio will not necessarily toggle into transmit mode, even though the TX light comes on. Just because the radio toggles into transmit, it doesn't mean it *is* transmitting.

In effect, therefore, the TX light was actually a PTT light—which is a bit misleading. The easiest way to turn this into a regular transmit light was by checking the antenna for outgoing RF. That was done as follows: a signal diode of the 1N914 variety was connected to the RF connector on the back of the radio (on the inside!!), using the shortest possible lead lengths; in series with this, a 100 kΩ resistor provided (again, using the shortest possible lead lengths) high impedance isolation between the antenna circuitry and our sampling circuit. With this high impedance and short lead lengths, effects on the antenna circuit is kept at a minimum.

I added a 3.3 MΩ resistor to keep the transmit LED from staying on, especially in the low-power position. Mount this resistor as near as possible to the antenna coax connector, with the shortest lead length possible. From this point on the radio's back panel, to where the LM393 is mounted, I used very thin, shielded coax, for two reasons: to minimize the reception of any unwanted signals from inside the radio, and secondly, to prevent RF still on the line from creeping into the radio's circuitry.

Adjust P1 so that the LED lights with the radio on low power. In all other respects, this circuit operates the same way as the high impedance squelch circuit previously described.

The LM393 dual comparator is a very versatile IC you can use for many applications. It is commonly available as a quad package from Radio Shack. I purchased the dual package from Jameco Electronics in California for 39¢. A very reasonably priced IC for the experimenter. You can use either the quad or the dual LM393 in these circuits.

So, there you have it: two useful mods for a very popular rig. Have fun and enjoy improved operation! ■

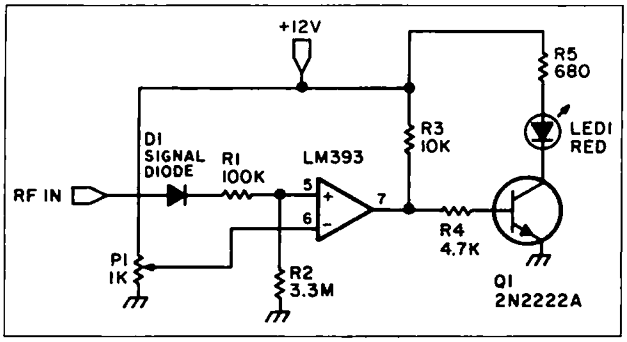


Figure 2. Circuit to drive the TX light. It samples outgoing RF from the antenna.

Decatur Ham Launches Satellite

A most unusual college project

by Mark Lambert WB8UUE

In 1957, a photo of 12-year-old Frank Wiesenmeyer and a few other hams appeared in their local newspaper. Sputnik, the world's first satellite, had just been launched by the USSR, and Wiesenmeyer's radio club was the only one in the area that knew where to listen for the beep-beep-beep of the space beacon. Now Wiesenmeyer K9CIS, and a group of 12 others in Decatur, Illinois, are the creators of their own satellite!

Educational Bird

EDSAT, an eight-sided satellite a little larger than a five-gallon pail, is expected to be launched by this group of Central Illinois enthusiasts in early 1989. The Space Shuttle will deploy this in the low-cost Getaway Special program offered by the National Aeronautics and Space Administration (NASA). (See sidebar.) The satellite will feature a CW beacon and an amateur radio transponder. It will receive signals on two meters at 146 MHz and transmit on a 436 MHz downlink. A CW beacon will transmit on 436.1 MHz.

Once the satellite is built, the EDSAT team will transport it to Goddard Space Center in a special five cubic foot container. The satellite will then be transferred to a Getaway Special (GAS) can for its Space Shuttle ride.

After the Shuttle reaches the desired orbit, the satellite will be shot out of the opened GAS can by a simple spring-loaded pedestal. It will have a 57-degree inclination at its high point and will orbit at an altitude of at least 350 kilometers. Because the simple device will not have any boosters to adjust its altitude, EDSAT's final position in the atmosphere won't be known until after launch.

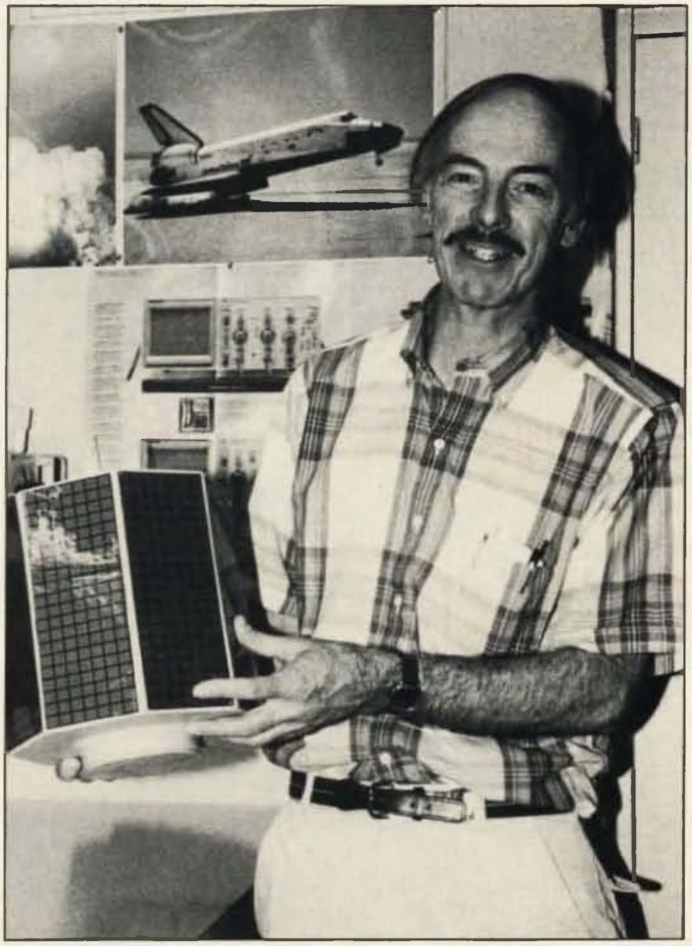


Photo A. Frank Wiesenmeyer with a model of the EDSAT satellite, expected to go up in early 1989.

The special launch canister was designed to spring a similar satellite into orbit in 1985. A team at Weber State University in Utah used a GAS can to launch NUSAT, a small satellite designed to calibrate radar for the Federal Aviation Administration.

EDSAT, Wiesenmeyer said, will be an educator's tool. The acronym stands for Educational Door to Space and Technology. "There were all kinds of interesting science experiments with the OSCAR series," Wiesenmeyer said, referring to the popular amateur radio satellite program. Of particular scientific interest was the telemetry, which included temperature readings, solar panel array current readings, and other related information. Wiesenmeyer is an associate professor of electronics technology at Richland Community College in Decatur, and he used OSCAR to introduce space to his students. For example, he taught them how to plot Doppler frequency shift as the satellite whizzed by, using it to calculate the satellite's altitude.

"It fit in perfectly with me," he said. "It provided an interest in space science, filled the bill for extracurricular science activity, and gave us an involvement in antennas and communications."

With the death of OSCAR 8 in 1983, however, Wiesenmeyer said the emphasis on education also died. Today's amateur satellites, he said, are intended more for communication and not as a space science tool. He

hopes EDSAT will restore the educational aspect to ham radio satellites.

EDSAT will use a speech synthesizer to speak directly to students. The voice messages will include the spacecraft's temperature, the condition of the battery and electronics, the satellite's position, and other data. As it orbits the earth, it also will transmit voice bulletins to users. A high-speed digital transmission mode will be available for advanced users with access to a personal computer.

Cheap (Relatively)

Wiesenmeyer said they designed the satellite with as many commercial off-the-shelf components as possible, to keep costs down and to encourage others to try satellite building on a limited budget. Donations of material also have been invaluable. General Motors donated the high-quality aluminum for the satellite shell, and Motorola donated radios for the bird's transponder. Even so, it will cost the college team $25,000 to launch the satellite. The device itself will be valued at $100,000.

Satellites have been the topic of discussion around Wiesenmeyer's small electronics lab

> *"He (Wiesenmeyer) hopes EDSAT will restore the educational aspects to ham radio satellites."*

since NASA announced the Getaway Special program in 1982. It wasn't until 1985, however, that the right combination of space enthusiasts came together at the college to get the project off the ground.

Twelve people form the EDSAT design, engineering, and advisory team. There are other instructors, local businessmen, farmers and students involved in the project. The team has completed design of the satellite and is beginning to bolt the hardware together.

Funds Needed

Now the real work begins. The group will launch a fund-raising drive this summer to come up with the $25,000 needed to put its creation in orbit. "It looks like our experiment is way up the ladder, and we will go soon after shuttle flights resume, so we need to be ready," Wiesenmeyer said. He talks about the launch with restraint, but it is obvious he is excited.

"Think about what went on in the seventies! We launched satellites and payloads to Mars and Venus, and Voyager went to Jupiter, Saturn, and on out to Uranus and Neptune," Wiesenmeyer said. "All those successes have had no real follow-up.

"We are obviously in a period of declining space activity, and that is something we hope to change."

Getaway Special

The Getaway Special (GAS) program was never intended to launch satellites. It was designed by NASA to carry science projects on the Space Shuttle and return them in an unopened cylinder.

A group of college students at Weber State College in Utah, however, requested in 1985 that a hinged lid be made available on one of the cans. They had done the unexpected, designing a satellite small enough to fit inside the 28-inch high cylinder. A hinged lid and a spring-loaded base inside the tube were needed to launch the bird.

The team successfully launched NUSAT in April of 1985 from the Space Shuttle Challenger. Already, the team led by an amateur radio operator at Richland Community College in Decatur, Illinois, was planning the second use of the modified can to launch another mini-satellite.

Getaway Special got its start in 1983 when 10 experiments by college students flew on the shuttle. Things like ant colonies and hybrid corn seed traveled up and back in sealed cans to test a variety of scientific theories. Since that flight, dozens of other experiments have flown, and reservations for hundreds more are waiting for shuttle flights to resume.

There are two sizes of GAS cans. The one used by each of the satellite groups is a five cubic foot cylinder which is 28 inches high. It will hold 200 pounds of material, and costs $10,000 per launch. The hinged-lid version costs about $25,000.

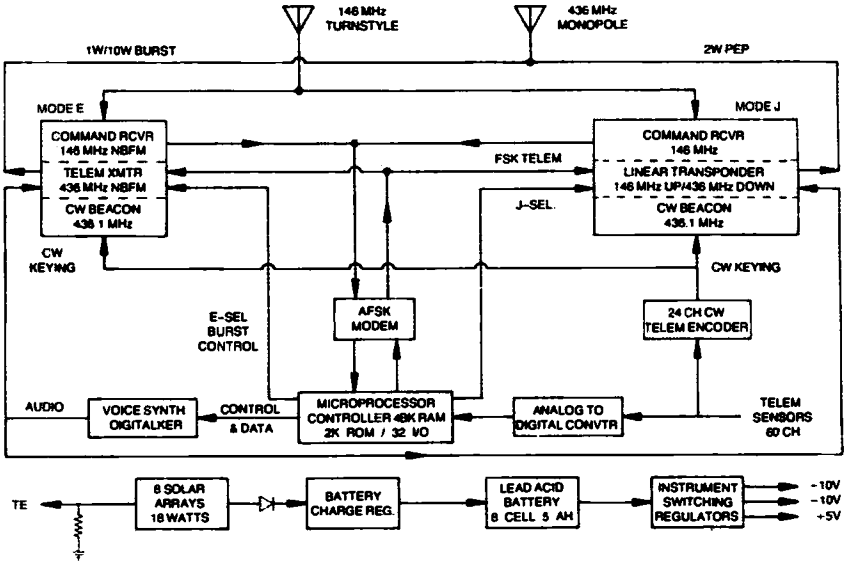
For experimenters with less grandiose projects, a 14-inch high cylinder is also available. It holds 2 ½ cubic feet of material. If you stuff it with 100 pounds of payload, it will cost you $5,000 per launch. Limit the baggage to 60 pounds and pay only $3,000.

According to NASA, sponsor of the program, GAS cans are leased only to non-profit groups to carry out space-related research and development. Foreign groups are welcome to rent a can, but each project flown must be "peaceful in nature." Shuttle astronauts will assist with a maximum of three remote on-off commands for each can.

Interested participants must classify their project in one of three categories: Governmental, Educational, and "Everything Else." A contract is signed with NASA and each group must pay $500 earnest money. NASA then sends each participant a videotape and manuals describing their responsibilities.

Projects are flown on a "space available" basis, and the fee must be paid in full before launch. If you are interested in learning more, contact: Getaway Special, Goddard Space Flight Center, Greenbelt, MD at (301) 344-6760.

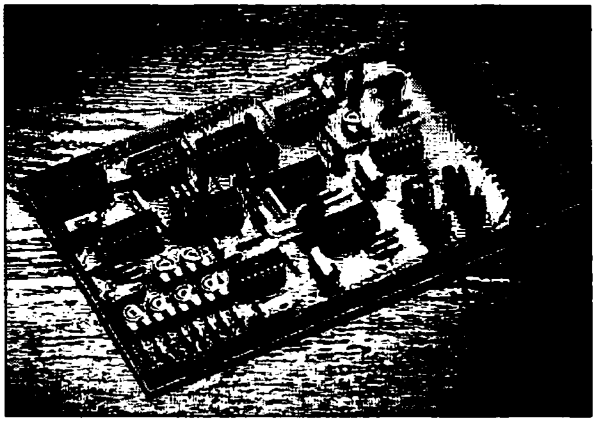
EDSAT Block Diagram



Charging Without Overcharging

This circuit conserves AC and charges—not chars—station batteries!

by Dennis Knittel WB8VQR



It's always a good idea to have an emergency power source for the ham station. Hams are often needed the most during power outages. Auto batteries are good to keep the 12 volt station running, but deep-cycle marine batteries from GNB, Sears, and others are ideal. Auto batteries are designed to provide a whopping current (100–200 amperes) for very short periods, such as needed to start a car, and to float the load—lights ignition, radio, and so forth—against the alternator the rest of the time.

The deep-cycle batteries, on the other hand, are designed to be fully charged, and then to provide a steady, medium range current (10–20 amperes) until discharged. Thus the deep-cycle is more appropriate to this application, but if the automobile batteries are free "pull-outs," or nearly so...

More Than Just Trickle Charging

A popular method has been to trickle-charge auto batteries while running gear off a power supply. When the power goes out, the battery takes over automatically. The problem with this is that unless the charging voltage is set exactly, and the condition of the battery monitored occasionally with a hydrometer, the battery will be either undercharged (leaving less reserve in an outage) or overcharged (driving off water and eventually killing the battery).

The circuit shown in the schematic uses two batteries alone to supply the station. When their voltages drop to a preset point, a control circuit activates the charger. One of the batteries begins to charge while the other continues to supply the station. After the first battery is charged, it powers the station while the second battery charges. After the second battery is charged, the charger shuts off and the station runs from both batteries. The charger draws AC only when needed. The charger doesn't need to be well-filtered because it doesn't run the station directly.

Since the equipment is not endangered, this method also allows the batteries to charge at 15.5 volts. Once the charger is removed, the batteries will be at about 13.5 volts. Charged at only 13.5 volts, the battery voltage would be only about 12 volts after removing the charger. In the following text, you will note that the set points of 12.25 volts for starting charge, and 13.50 for stopping, are values for new batteries. If your batteries are older, you could use lower numbers like 12 and 13 volts. This just means slightly different settings on R6 and R5, respectively. Be aware of voltage drops due to the voltmeter when adjusting the potentiometers.

Outage Warning

During an outage, the station continues to operate from the batteries. When the controller begins to charge the batteries, however, it discovers the outage and sends a pulsating audio warning to indicate trouble. This audio can be piped to useful locations, such as to a speaker in the ham shack, or through a transmitter audio input at a repeater site. The controller can also switch the equipment to low-power operation during the outage. It won't allow the batteries to over- or undercharge. The batteries power the controller, which, due to its mosdy CMOS circuitry, draws under 2.5 mA.

Voltage Reference

The controller circuit requires a voltage reference. Voltage reference criteria are: stability, low current draw, and over-voltage detection. Over-voltage protection is set a little above the normal peak charge. If, for example, the batteries are charging at 15.5 volts, a good over-voltage point is 16 volts.

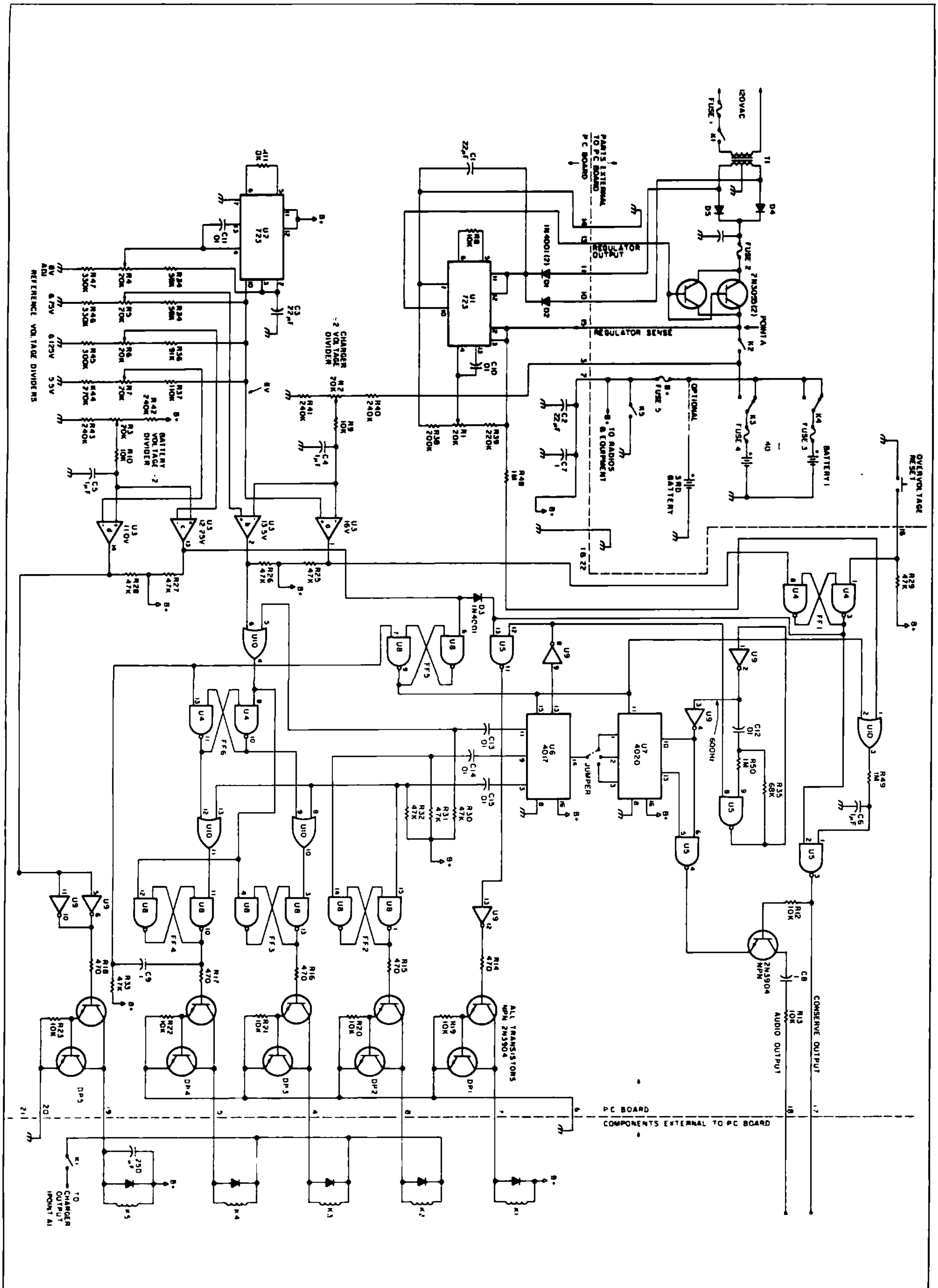
It's easy to derive a stable 16 volt reference from batteries that fluctuate between 12.25 and 13.5 volts. A 723 voltage regulator chip (U2), powered from the batteries, is set for an 8 volt output. A voltage divider (R40, R2, and R41) divides charger voltage in half and compares it to the 8 volt reference from the 723. If the divided charger voltage goes above the reference voltage, the controller removes the charger from the AC line and begins the audio warning. It remains this way until manually reset. This over-voltage protection keeps the batteries from overcharging, and protects the equipment from what might well be a fatal over-voltage.

An LM339 voltage comparator chip (U3) monitors four voltage points. The four points are: 16 volts (over-voltage), 11 volts (under-voltage), and the two inner limits of 12.25 and 13.5 volts, which control battery charging. All reference voltages for the 339 come from the 723 voltage regulator, and are separately adjustable. The capacitors and the series resistors, which are after the battery and charger voltage dividers, smooth out any spikes caused by load changes so that the comparators are not accidentally tripped.

Circuit Operation

Normal operation begins with comparator U3c. When it detects that the batteries have run below 12.25 volts, it sets flip-flop #5 (FF5). This starts the 600 Hz oscillator, and the 4020 and 4017 divider chips. FF5 also causes Darlington pair #1 (DP1) to ground relay #1 (K1), that connects the charger to the AC line. The time when FF5 starts the divider chips is the time reference for other events described later. The 4020 is a unique CMOS chip in that it is capable of division by as much as 16,384. Its last three outputs divide the 600 Hz down to one cycle every 6.83, 13.65, and 27.3 seconds.

This explanation uses the 1 cycle/6.83 second output. It gives 54.6 seconds of charge to the battery during each cycle. The 13.65 second output gives 109.2 seconds of charge, and the 27.3 output gives 218.5 seconds per cycle to the battery. If the batteries require longer charging cycles, the 13.65 or 27.3 second outputs can be used, giving the longer times. Select the desired output with a jumper on the printed circuit board. The circuit recycles on each battery until it is fully charged, eliminating the need to worry about undercharging. Using too short a charge cycle, however, causes the circuit to test the battery voltage before it stabilizes. This fools the


120VAC
PARTS EXTERNAL TO PC BOARD
PC BOARD
REGULATOR OUTPUT
REGULATOR SENSE
POINT A
REFERENCE VOLTAGE DIVIDERS
BATTERY VOLTAGE ÷2 DIVIDER
CHARGER ÷2 VOLTAGE DIVIDER
TO RADIOS & EQUIPMENT
OPTIONAL
3RD BATTERY
BATTERY 1
OVERVOLTAGE RESET
JUMPER
ALL TRANSISTORS NPN 2N3904
AUDIO OUTPUT
CONSERVE OUTPUT
COMPONENTS EXTERNAL TO PC BOARD
TO CHARGER OUTPUT (POINT A)

circuit into prematurely thinking that the batteries are charged, causing unnecessary cycling and relay wear.

We now have a 6.83 second cycle from the 4020 (U7) clocking the 4017 (U6). Each output of the 4017 starts with output #Ø and will sequentially go higher for 6.83 seconds while all others remain low. At Ø seconds (when FF5 sets) output #Ø goes high. At 6.83 seconds output #Ø returns low and output #1 goes high. At 13.65 seconds, output #1 returns low and output #2 goes high. This continues through output #9 and then begins over again at output #Ø.

When output #Ø goes low at 6.83 seconds, it causes a one millisecond negative output pulse from the capacitor-resistor network (C15 and R32). This pulse sets FF2 and FF3, causing DP2 and DP3 to ground K2 and K3. This means that 6.83 seconds after FF5 sets and the charger comes on and stabilizes, the first battery begins charging. The second battery continues to supply your radio equipment. At 61.44 seconds, the 4017 output #8 resets FF2, releasing K2, and stops the charging. At 68.27 seconds, the 4017 output #9 causes a voltage check on battery #1. If the voltage is under 13.5 volts then at 75.09 seconds the 4017 output #Ø sets FF2 again and reconnects battery #1 to the charger for another round. If voltage is over 13.5 volts then FF3 is immediately reset, causing battery #1 to return to supply the load. At 75.09 seconds, FF2 and FF4 cause battery #2 to begin the same charging cycle that battery #1 had used. At 129.71 seconds, FF2 resets and releases K2, stopping the charging of battery #2. Its voltage is allowed to stabilize and at 136.53 seconds the voltage is checked. If under 13.5 volts, the charge cycle for battery #2 begins again at 143.37 seconds. If over 13.5 volts, the entire circuit resets immediately. The charger is disconnected from the AC line, and everything waits to be called into action again. If battery #1 has fallen below 12.25 volts by the time battery #2 is checked and found to be over 13.5 volts, the charger will not shut off. Instead, the sequence restarts by charging battery #1 and then battery #2. This means that if there is a heavy load, the batteries will continue to charge alternately.

Over-Voltage Protect

If over-voltage should ever occur, FF1 will set, causing DP1 and K1 to disconnect the charger from the AC line. FF1 also causes the conserve output to go to the high state. This output can advise the equipment to go to a power saving mode. FF1 also sets FF5 via the diode, starting the oscillator, and allowing the audio output to send out a pulsed tone to indicate trouble.

The over-voltage circuit is reset by applying a "low" to the reset input of FF1. This stops the beeping and restarts the charging. The reset can be remote controlled unless the remote reset continuously trips out, which means a trip to the remote site to correct problems. The conserve and audio outputs will also operate if voltage doesn't reach point A, (due to AC power line failure, charger melting, etc.), when a charging cycle begins. In this case, an attempted reset is ineffective. Everything will return to normal when voltage does reach point A (the power comes back on or the charger is replaced), this time with properly sized fuses. The one megohm resistor (R48) between point A and the AND gate input is to insure that the gate is not destroyed by its input, (which is being forced higher than the B+ supply to the chip). The one megohm resistor (R49) and the one microfarad capacitor (R49, C6), on the output of that gate, causes a delay to prevent falsing of the audio.

If the controller is beeping and is not attended to, the battery voltage eventually drops to 11 volts. If this happens, the output of the comparator U3d goes to a low state. This causes DP5 to ground K5, which in turn shorts B+ to ground and blows the B+ fuse. This feature is provided to protect equipment that may be damaged by overly low voltage. The beeping that begins, as the batteries drop below 12.25 volts, should give enough time to correct the problems before the 11 volt "self-destruct" point is reached. There are other uses for U3d and K5, such as starting a back-up emergency generator or changing the beep rate (to indicate the batteries are really on their last leg).

A second 723 U1 is provided on the board for regulating your charger. It can control a string of 3055s. The 723 does not have to be used, but if it's not, it still must tie point A to the charger output. The circuit is able to continue detecting the power line or charger failure. Capacitors placed off the printed circuit board pins are used for sensing and regulator output to keep the 723 stable.

A third battery can be added after the relays but *before* the B+ fuse. Once a heavy load is applied, a third battery will help prevent excess voltage drop caused by wire and relay contact resistances. It may also save your equipment's volatile memory from loss due to dirty relay contacts. The third battery will remain charged by the first two.

The contacts of K2 should be able to handle the current power supply charging the batteries. The K3 and K4 contacts should each be able to handle the largest current that the equipment will demand of the batteries. Don't forget the reverse surge protection diodes across all relay coils.

I recommend using larger (500 Ah+) batteries. They hold a charge longer and require fewer charging cycles.

I hope you will find this project useful for setting up a more secure and economical battery backup system. 73

Parts List

Quantity	Parts number	Description
2		2N3055 power transistor
11		2N3904 NPN transistor
3	D1–D3	1N4001 diode
2	D4–D5	20 amp 50V on heatsinks
2	U1–U2	723 voltage regulator
1	U3	339 voltage comparator
2	U4–U5	4011
1	U6	4017
1	U7	4020
1	U8	4044
1	U9	4069
1	U10	4071
3	C1–C3	22uF electrolytic
3	C4–C6	1uF
3	C7–C9	.1uF
6	C10–C15	.01uF
7	R1–R7	20kΩ
5	R14–R18	470Ω ¼ resistor
11	R8–R13, R19–R23	10kΩ resistor
1	R24	39kΩ resistor
9	R25–R33	47kΩ resistor
1	R34	56kΩ resistor
1	R35	68kΩ resistor
1	R36	91kΩ resistor
1	R37	110kΩ resistor
1	R38	200kΩ resistor
1	R39	220kΩ resistor
4	R40–R43	240kΩ resistor
1	R44	270kΩ resistor
1	R45	300kΩ resistor
2	R46–R47	330kΩ resistor
3	R48–R50	1mΩ resistor
3	K1, K2, K5	Relay 12 volt coil 20–25 amp SPST contacts
2	K3, K4	Relay 12 volt coil 20–25 amp SPDT contacts
5		200 volt amp snubber diodes for relay coils
1	T1	Power transformer
1	F1	Fuse 5 amp
4	F2–F5	Fuse 20 amp 3 AG*

A surplus 3-phase magnetic circuit breaker can be substituted for fuses F3-F5 to disconnect all power in case of overcurrent in any leg. Remove B+ (coming through F5) also disables AC input through the contacts of K1.

*Do not substitute slow-blow for F5.

Number 12 on your Feedback card

NEW PRODUCTS

Compiled by Linda Reneau

PRODUCT OF THE MONTH

AMERICAN ANTENNA

American Antenna has a new 10 meter antenna, the Ham-Ten, whose design is based on their K-40 CB antenna. It will handle power input up to 1500 watts when properly installed, and has a bandwidth of 1.5 MHz between 2:1 SWR points. The Ham-Ten complements all the single-band 10-meter rigs currently on the market. An adjustable trunk lip mount comes with the Ham-Ten, or you can use American Antenna's Magnamount.

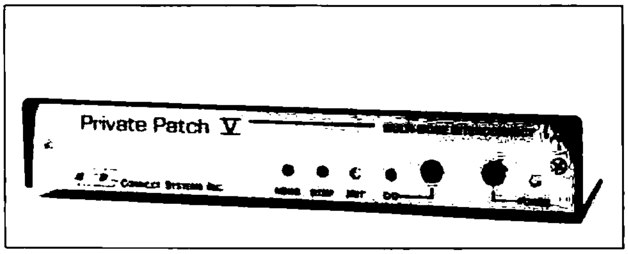
Price for the Ham-Ten is $45.50. For further information, write *American Antenna, 1575 Executive Drive, Elgin IL 60123.*

dbx PROFESSIONAL PRODUCTS

dbx announces new software enhancements and price reduction (from $6,950 to $4,500) for the RTA-1 Professional Real-Time Analysis System. The features include enhanced room-response curve capabilities, and customized printout. Present owners of the RTA-1 will be able to upgrade their equipment. The new version, designated RTA-1 V.1.5, also offers improved confidence indication and faster automatic gain setting. Direct readout of dB SPL is now possible, and the V.1.5 stores information for up to ten microphones, allowing calibration for any microphone and use of a microphone calibrator for automatic correction. Users may enter a 1–42 character banner at the top of the printout. Printouts also contain an area for location, date, time, and other notations. For more information contact *dbx Professional Products, PO Box 100C, Newton MA 02195. Or circle Reader Service number 207.*

WA9YWJ PRODUCTS

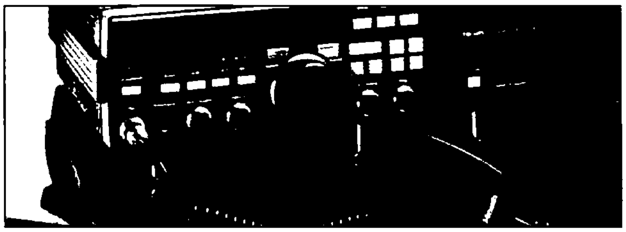
WA9YWJ offers a custom photo engraved callsign plaque on ¼" thick glass in a gold-colored frame. You can choose a red, blue, black, or green velvet background. The callsign plaque is 7" long x 2¾" wide. WA9YWJ guarantees its craftsmanship. Price: $24.95 plus $2 shipping. *WA9YWJ Products, 907 Baxter Ave., Superior WI 54880.*



CONNECT SYSTEMS INCORPORATED

CSI's Private Patch V can be programmed in four modes: Sampling Patch (VOX enhanced), VOX Patch (with remote), Duplex Patch, and Repeater Controller with Duplex Patch. It has a built-in keyboard and digital display, a 90-number auto-dialer, redial, remote hook-flash, programmable CW ID, toll protection, 1–5 digit access code, 2–5 digit secret toll override code, telephone remote base, remote controlled relay, and regenerated tone/pulse dialing. Options include a plug-in CTCSS conversion board and an electronic Voice Delay board.

Price is $500. Contact *Connect Systems, Inc., 23731 Madison St., Torrance CA 90505. 213-373-6803.*



HEATH COMPANY

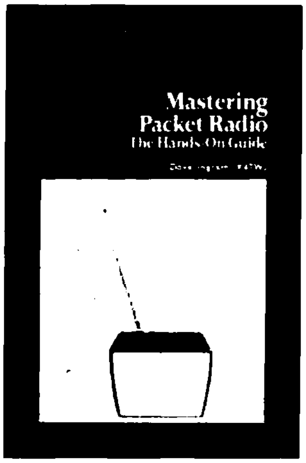
The SB-1400 All-Mode Transceiver is now available from Heath Company. It provides all-band, all-mode coverage with 100 watts of transmit power on all nine HF amateur bands. Maximum AM output is 25 watts. The SB-1400's receiver has 0.25 μV (or better) sensitivity, dual VFOs, RIT, a built-in 500 Hz CW filter, "split" operation, squelch in all modes, 20 memories, front panel controls and AGC action, and computer interface. Available accessories are: 20 amp power supply with speaker, FM module, hand-held microphone, mobile bracket, and switching relay. The SB-1400 is a no-frills transceiver with all the important features. Price is $800. To order, call *800-253-0570 or 800-44-HEATH*, or write for a Heathkit catalog at *Heath Company, Department 350-036, Benton Harbor MI 49022.*

ADVANCED COMPUTER CONTROLS, INC.

Advanced Computer Controls' new RC-850 Repeater Controller Computer Interface allows remote control, programming, and information access to FM repeater systems from a home computer or terminal via modem or packet TNC. Controller commands may be entered through the remote terminal with responses displayed on the terminal screen. The controller stores programmable speech and Morse code messages. The menu-driven RC-850 has two additional Touch-Tone decoders to offload the main shared decoder for full-time coverage of links and remotes.

The RC-850 Interface is $350. For $75 more, the Vocabulary Expansion Option increases the synthesized speech to 530 words. Contact *Advanced Computer Controls, Inc., 2356 Walsh Avenue, Santa Clara CA 95051. 408-727-3330.*

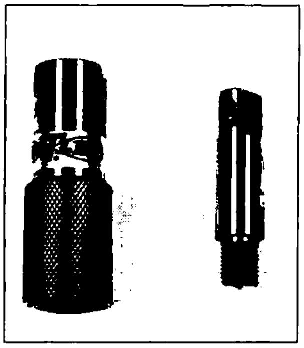
HOWARD W. SAMS & COMPANY



Mastering Packet Radio: The Hands-On Guide, by Dave Ingram K4TWJ, is now available from Howard W. Sams & Company. The book covers basic concepts as well as the more technical areas of this mode. It describes what packet is, how it works, why it is, and the hardware involved. Dave Ingram K4TWJ has written twelve books and over 300 articles for amateur radio magazines. He holds a First Class Radiotelephone Commercial License and an Amateur Extra Class License. *Mastering Packet Radio* retails for $13 and is available at bookstores, computer stores, electronics distributors, or direct from the publisher by calling 800-428-7267. *Howard W. Sams & Company, A division of Macmillan, Inc., 4300 West 62nd Street, Indianapolis IN 46268. 317-298-5400.*

CURTIS MANUFACTURING COMPANY, INC.

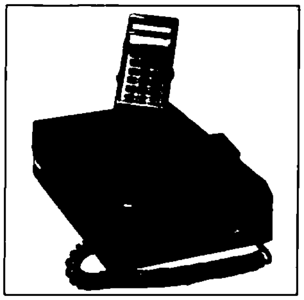
Curtis Manufacturing's Anti-Glare Filter for computer monitor screens is made of distortion-free optically-coated glass. It absorbs 95% of reflected light internal and external to the computer monitor. The all-glass Anti-Glare Filter increases contrast and character resolution. The Filter comes in seven sizes to fit most color and monochrome computer monitors. It carries a lifetime warranty. Suggested retail price is $60. *Curtis Manufacturing Company, Inc., 30 Fitzgerald Drive, Jaffrey NH 03452. 603-532-4123.*



HUSTLER INC

Hustler, Inc., has a new version of Quick Disconnect, the Model QD-2. The QD-2 is similar to the original Model QD-1, but it features a new design for the lower half. Milled from a solid piece of stainless steel, the new design is virtually indestructible. The warranty extends to two years. For more information, contact the Sales Department at *Hustler, Inc., 1 Newtronics Place, Mineral Wells TX 76067.*

RADIO TEL

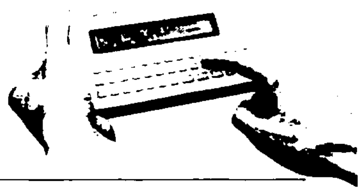


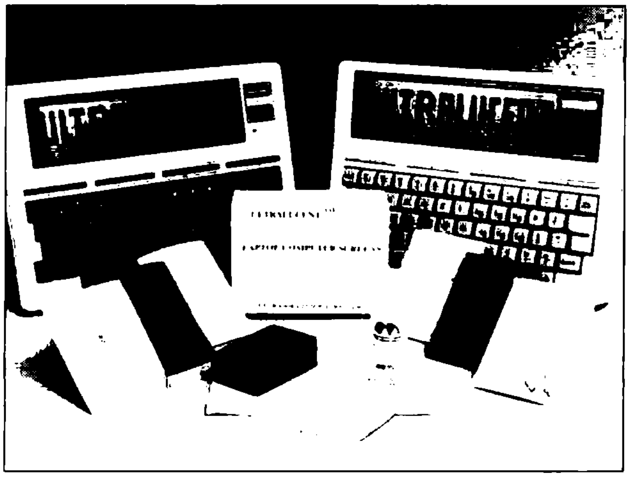
Radio Tel offers a full duplex private mobile phone as an extension of a regular home or business phone up to 30 miles away with no separate monthly phone bill. Send or receive calls from anywhere in the world. Outgoing calls appear on the regular phone bill. This system operates on VHF (138–174 MHz) or UHF (440–512 MHz) with a 5 MHz transmit/receive split for duplex. Optional features are voice scramblers, intercom, and selective calling for multi-users. Prices start from $2,995 for the entire system. *Radio Tel, 1025 S. La Brea Ave., Los Angeles CA 90019. 213-937-6766.*

MOTOROLA INC.

The KDT portable data terminal provides communication between the people in the field and the central computer data files. It features a 4-line by 40-character super-twist, backlit LCD display. The terminal is battery-powered and contains an integrated radio transceiver for cordless operation. The unit weighs 30 ounces and is small enough to hold comfortably in one hand. The KDT has up to 96K of memory. Code reading and other accessories are available. The terminal is compatible with Motorola's Data Radio Network.

Price for the data terminal is $3300. Contact *Motorola, Inc., 1301 E. Algonquin Road, Schaumburg IL 60196. Attn: Nadine Sudnick, 312-576-6640.*





ULTRASOFT INNOVATIONS, INC.

ULTRALUCENT™, from Ultrasoft Innovations, Inc., is a screen restoration product that eliminates hairline and deep scratches from the hard plastic display of any laptop or notebook computer. It comes in a standard kit that includes 6 re-usable, color-coded, abrasive pads, anti-static finishing cream, application foam block, wiping towel, and complete instructions for $20. For minor touch-ups, and for laptops with soft plastic displays, ULTRALUCENT EL is available for $15. *UltraSoft Innovations, Inc., 76 Main Street, PO Box 247, Champlain NY 12919, 514-487-9293.*

BUCKMASTER PUBLISHING

Originally designed for librarians, the Place-Name-Index CD-ROM from Buckmaster Publishing contains information valuable for amateur radio operators. It offers quick access to more than one million place names collected from the quadrangle maps of the US Geological Survey. Each record on the Place-Name-Index contains the state, county, feature type, FIPS code, elevation, longitude/latitude, and quadrangle map name. Search on place name, multi-word phrases, wildcards, and other terms. The user can find the longitude and latitude of a contact in seconds.

The Place-Name-Index CD requires a Hitachi, Phillips, or Sony CD-ROM drive. The user can store search results on disks or printouts. The Place-Name-Index CD-ROM leases for $295 and sells for $1,495, including retrieval software. *Buckmaster Publishing, Whitehall, Route Three, Box Fifty-six, Mineral VA 23117. 800-282-5628 or 703-894-5777. Jack Speer N1BIC, President.*

73 Review by Pete Putman KT2B

Number 13 on Feedback card

Communications Concepts 335A-K

2 meter 35 watt amplifier kit

Communications Concepts Inc.
121 Brown Street
Dayton OH 45402
(513) 220-9677
Prices: $79.95 kit
$109.95 assembled

Communication Concepts Inc. has advertised this amplifier for several years. Basically, it is a gain block with T/R switching to boost a low-level 2 meter signal, such as a handheld, from 1–3 watts up to the 30–35 watt range. Unlike other amplifiers made by RF Concepts, Mirage, and THL, no preamplifier is available. It is strictly a no-frills way to add better than 13 dB to a handheld. (This review is somewhat unusual, as the product is sold as a kit, but the review unit arrived completely assembled.)

The circuit is straightforward. A Motorola MRF-240 is used in a grounded-emitter configuration, running Class AB1 bias for true linear operation. Hence, this amplifier can be used on sideband as well as FM and CW. The disadvantage of this is that idling bias current is always drawn, and there is no power switch. This means the user has to tie into a switched DC line when using the amplifier in a car, or else the battery runs down in short order.

Photo A shows the PC board. Workmanship on this model is good quality, and the component layout, plus simplicity of design, should allow any experienced builder to achieve similar results. All the components mount on the top plane of the PC board, except the bias regulator Q3, which mounts below. The layout is uncluttered, as only small components are used. RF keying switches the antenna relay, but there's no provision for hard-keying.

The DC power connector is a standard 4-pin TRW/Jones type, but only two pins are needed. This might be a good place to bring out a hard keying line, which could be nothing more than a 4.7k resistor to the base of Q2. Input and output RF connectors are BNC types. SO-239 connectors would have been better choices, since they hold up better in mobile nvironments.

Performance

Input	Output
.3 W	3.0 W
1.2 W	25 W
2.3 W	30 W

Note: Maximum input specified by manufacturer to be 5 watts.

"... the manual is so thorough that inexperienced builders might want to try it as their first RF project."

Instructions

The instruction manual is well written and contains a check-off box for each series of instructions (a la Heathkit). The tune-up procedure is simple but does involve a trial-and-error method of soldering and resoldering the chip capacitors, along the etched lines to obtain lowest VSWR. The manual does include several pictorials and a component layout to speed things along. In fact, the manual is so thorough that inexperienced builders might want to try it as their first RF project.

Conclusion

The CCI 335A-K is a no-frills amplifier kit that appears to be easy to construct and uses top-quality components. An amplifier such as this can serve many purposes. For example, it could be used to provide higher drive for grounded grid amplifiers, such as the 3CX800 or 8877 tubes which need at least 30 watts or more to really perk. It could also be used as a booster amplifier for QRP contest work, and, of course, it can be used to kick up the signal from a handheld while portable, at home, or in the car.

Photo A. Interior of the assembled 335A-K amplifier. Note the uncluttered PC board.

Number 14 on your Feedback card

73 Review *by Bill Clarke WA4BLC*

The Carolina Windom Antenna

Improvement on a tried and true design.

Radio Works
PO Box 6159
Portsmouth VA 23703
PH: (804) 484-0140
Price Class: $70

The Carolina Windom Antenna.

The Windom antenna was first invented in 1928 by W8GZ, and immediately became popular. Like many older types of antennas, however, it eventually faded into obscurity. Although the Windom popped up from time to time with a new twist or two, it never became really popular again, mainly due to the inherent feeding problems.

The last Windom I saw in everyday use was in 1972, which belonged to a fellow in Cape Cod. It was a 1928 classic, fed with a single conductor. He used it only on 75 meters AM phone. It put out a loud signal heard regularly in Virginia.

The Windom has reappeared once again, reinvented by Joe Wright W4UEB, Jim Wilkie WY4R, and Edgar Lambert WA4LVB. So much has changed with this new version, though, that they now call it the Carolina Windom—"Carolina" for that beautiful part of the country where much of the improvement on it was done, and "Windom" for the basic off-center feed concept.

Theory of Operation

The only real resemblance the Carolina Windom has to the original is the off-center feedpoint. The off-center feed creates an imbalance, which causes the feedline to radiate. The feedline and antenna then produce both vertical and horizontal polarization patterns—horizontal along the wire elements, and vertical from the feedline. The manufacturer claims that this combination of radiations is what makes the Carolina Windom successful.

While most transformers try to eliminate feedline imbalance and radiation, the Windom's matching transformer, at the feedpoint, is designed to encourage feedline radiation. But this radiation must be controlled. A line isolator, installed twenty-two feet from the horizontal element's feedpoint, acts as a brute force RF choke, to limit the vertical radiator at a predetermined length and to keep RF out of the shack.

The overall design provides an antenna that is usable across the entire 75/80 meter band without an antenna tuner. Operation on other HF bands requires a tuner. 40/75/80 meter patterns are horizontal with vertical components. 20/15/10 meter radiation is primarily vertical. On the higher bands, the effect is an upside-down vertical with the horizontal elements as the radials, and the feedline as the vertical element.

Installation

I installed the Carolina Windom as a sloping dipole, with the apex at a height of fifty feet. I oriented it the same as my trusty 160/75/40 meter fan dipole, figuring this would afford me a chance to make comparisons. I used seventy-five feet of feedline (seventy feet or more recommended) and placed my tuner in the line. After an initial smoke test, I compared my results with the Radio Works SWR curve (see Figure 2). They displayed the same general curve, but my SWR curve was one full point higher than the one shown in Figure 2.

I then tried to load the antenna on other bands by using the tuner. All was well except for 15 meters. There, it was no-go under any circumstances. I decided to change feedlines and put a forty-five footer on. It worked great. All bands tuned up easily, and the SWR on 80 dropped to where the book said it should be. I checked the feedline, and have since placed others of varying length in service. Evidently, the Carolina Windom antenna is "feedline-length" conscious.

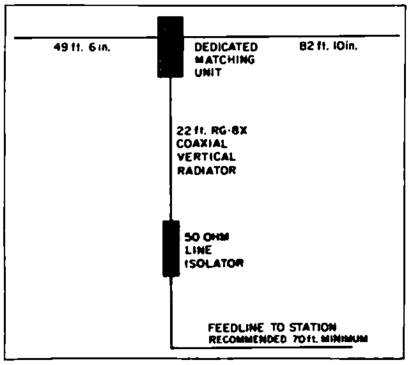


Figure 1. Diagram of the Windom antenna.

Specifications
(as stated by the manufacturer)

Coverage:	80–10 meters
Gain:	3–5 dB gain over a dipole
Radiator Length:	Horizontal 132'; Vertical 22'
Feedline:	50Ω Coax
Matching Method:	Dedicated Matching Transformer & User's
Transmatch Requirements:	40–10 meters
Power Rating:	1500 Watts
Recommended Height:	Above 35'
Radials:	Not Required

Table 1.

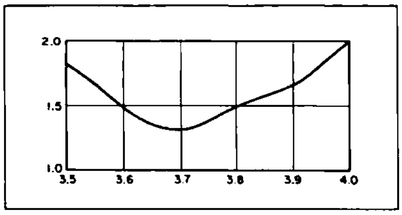


Figure 2. Typical 75/80 meter SWR curve shown in the Radio Works instruction sheet. The curve this reviewer came up with, using 75 feet of feedline, resembled this figure, but was a full point higher.

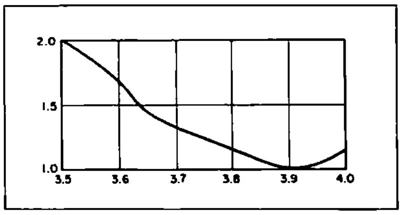


Figure 3. SWR curve of the Windom on 75 meters after slightly shortening the two elements.

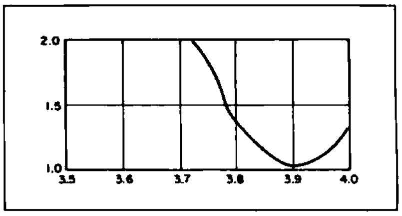


Figure 4. Typical SWR plot of a full-sized 75/80 meter dipole.

Operation

On 75 meters I found that the antenna consistently performed as well, or slightly better, than my dipole. When working stations with 20+ over nine signals, I could hear only small differences between the dipole and the Windom. Reception reports indicated about the same for my signal. However, very obvious performance gains were seen when working stations at S-5 or S-6 levels. The Windom won every time.

Since the initial installation, I have used the Carolina Windom on 10, 15, 20, and 40 meters. All tests have indicated that the antenna performs as advertised. On 40, it consistently performs better, on the long haul, than the dipole, no doubt due to the vertical radiation component. On close contacts, it is always at least equal to the dipole. When I compared the Windom to a tribander, I found that what it lacked in directional capabilities, it made up for with vertical polarization. Signal reports were generally better on the beam than on the Windom, and I could not turn to get away from offending QRM. However, I had no problem working stateside or DX stations.

Changes

In the booklet that accompanied my Carolina Windom, I saw a brief mention of optimizing the antenna for the 75 meter band. I took this to heart and reduced the shorter element's length by one foot, and the remaining element by three feet. The results were transparent on 40–10 meters, however the 75 meter SWR dropped down to that of my dipole. This is a worthwhile adjustment (see Figure 3).

Impressions

First impressions of the packaged Carolina Windom are good. The package contains two custom-made assemblies (feedline transformer and isolator), quality end insulators, stranded #14 copper wire, pre-built vertical coax element, and even a pack of coax seal.

It offers unusual bandwidth on 75/80 meters, something my dipole cannot do (see Figure 4). Though the antenna is about the same size as a full-size 80 meter dipole, and is fed with a single coax feedline, you can work all bands with a tuner. Using a plain, 80 meter dipole and a single feedline, you cannot efficiently do this.

The $69.95 price tag is reasonable. After all, you could invest more than $45 in the materials alone, if you could find them all, and you would still have to measure and cut the vertical and wire elements, install the coax connectors, solder the cut elements to the center insulator, put the end insulators in place, and then build your own RF isolator. How much is your labor and time worth?

The Carolina Windom would make an excellent "take-along" antenna for vacations and field day. If you are looking for a good wire antenna that can do it all, and don't mind using a tuner on the higher bands, the Carolina Windom is likely for you. ■

Number 15 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell PE KØOV
PO Box 2508
Fullerton, CA 92633

Loops: A Love/Hate Relationship

"What equipment do I need for T-hunting?" That's the most common question I hear. This month we'll begin to look at the many types of radio direction finding (RDF) gear. Stick around for plenty of no-nonsense advice on what equipment to choose for your particular hunting needs.

Would-be T-hunters have had trouble finding information on the sport in ham magazines. Of the few articles that have made it into print, a large percentage of them have been about making and using loop antennas. It's easy to see why.

Loops are the simplest RDF antennas to build. They're small and easy to mount, or you can hold them out the car window. They can be made for any of the popular ham bands. In an hour or so, you can have one ready to go.

T-hunt loops aren't like the full-wavelength square or delta loops DXers use. Loops for RDF are small, usually less than 1/10 wavelength in circumference. Electrically, they behave more like a coil than like a wire antenna.

I have a file folder full of articles on simple RDF loops, taken from major magazines and club newsletters. It's fun to read the authors' claims. Here's one for two meters that says, "Throw your competitors for a loop! A little practice will make you an expert, and you'll be able to invite your fans, family, and friends into your trophy room . . ."

These claims are reminiscent of the "hidden antenna" articles in which the author says he worked DXCC in a weekend after hooking his rig to a downspout through a tuner made of old bedsprings. STOP! Time for a reality check. It just isn't that easy.

Left or Right?

The biggest problem with simple loops is that they're bi-directional. As you rotate the loop 360 degrees, you get signal peaks when the plane of the loop is in the direction of the source, and nulls (minimum signal points) through the loop at the source. The peaks are broad and the nulls are sharp, so the nulls give greatest RDF accuracy. But there are two nulls, and they're in exactly opposite directions.

"The biggest problem with simple loops is that they're bi-directional."

How do you figure out which way to go when the RDF system has 180 degree ambiguity? You could take bearings from two widely separated locations and triangulate, but that would involve too much time and mileage. You could circle in from the edge of the hunt boundary area, instead of starting at the center—but even if the hunt rules allow you to do that, you'll probably lose time or mileage because you have to pick the most distant edge. Or you could watch to see which way the hunters with uni-directional antennas start out. But you don't want to follow them, do you?

Though there are ways to electronically solve the bi-directionality problem at 2 meters, none of the VHF loop designs I've seen in the magazines have such a feature. Parasitic elements, like directors and reflectors, will not work on a fractional wavelength loop antenna. Shielding methods, such as screens and metal plates won't make them uni-directional, either. The most effective way is to add a nondirectional whip to the antenna system. Then sum the whip and loop outputs with just the right amplitude and phase relationship, to either enhance one lobe or create a cardioid (heart-shaped) pattern. For decades, this loop/sense scheme has been standard for RDF below 60 MHz. It's tricky at 2 meters, but it can be done. (For details of a simple loop/sense system for 2 meters, see page 27 of *Transmitter Hunting—Radio Direction Finding Simplified*, TAB Books #2701, available from Uncle Wayne's Bookstore.)

Loops Hate Multipath

It is common in VHF transmitter hunting for the signal to arrive from more than one direction. This is called "multipath." It occurs because features of the terrain, such as mountains, hills, and buildings, reflect VHF signals. Good performance in multipath situations is an important feature of a successful RDF system.

Null-hunting with a loop can be very frustrating when multipath is present. As the hunter sweeps his loop past the direct signal, trying to find the exact null direction, the null is filled in by a signal arriving from the reflection. Even if the reflection is much weaker than the

The surplus AT-339/PRC loop and a portable receiver make a nice mobile or hand-carried RDF system for 6 meters. George Stokes WT6U and Bob Miklos K6LPF are ready to hunt.

Continued on page 54

Homing In

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direct signal, it may be impossible to get a correct bearing on the direct signal.

Hunters using beams can distinguish the peaks of direct and reflected signals as long as there is sufficient signal level difference. Furthermore, when the signal is weak, the higher gain and larger capture area of the beam make it a much better performer than the loop.

Forget Loops?

Were all those guys who wrote glowing descriptions of their 2 meter loops wrong? No, just overtly enthusiastic. Either they didn't have serious competition, or they didn't realize how much more successful they'd be with a better setup.

The loop is not the best tool for the task. It may be your idea of fun to enter a 20 meter DX contest with a QRP rig and a grounded vertical, but you wouldn't do it with the expectation of winning (unless everyone else in the contest had QRP and a vertical). You need something much better to be truly competitive against the big gun stations. In T-hunting, it's the same.

Several years ago, Dick Reimer W6ET knew there was a 2 meter repeater jammer in his neighborhood, because the jammer had a strong signal on the input. Dick didn't have RDF gear at the time, so he spent a couple of hours building a simple 8-inch diameter loop. It gave good nulls, and its 0.3 wavelength size gave it good sensitivity. The jammer cooperated (unknowingly) by staying on the air and being in a location free of multipath. W6ET tracked him down in short order, and ended the problem.

"Null-hunting with a loop can be very frustrating when multipath is present."

In that situation, a loop can do the job well, but the serious sport hunter would not want a loop as his primary RDF system on a competitive hunt against experienced hunters. W6ET knew that, so he later got a commercial Doppler RDF for serious hunting.

As part of my T-hunt talks to local radio clubs, I used to demonstrate W6ET's loop as an easy way to get started on T-hunt contests. I don't do that any more. Loops have their place, but competitive 2 meter T-hunting around Los Angeles isn't one of them. Signals are too weak, and the hiders usually pick spots in the hills or in urban areas that make the signal ricochet around like a ping pong ball.

If you want to get started simply and cheaply in 2 meter hunting, and you want a fighting chance against big gun hunters, my advice is to skip loops and use a simple qu d or beam. It's a bit more wor :, but there'll be no null-fill or bi-directionality problems to worry about. You'll get much more signal, too.

Try a Loop on HF

Loops are far more successful on 6 and 10 meters, since there is much less multipath on these bands. Signals are stronger because they must overcome atmospheric noise to be heard. The Southern California Six Meter Club sponsors a monthly dual-band 6 and 10 meter hunt in the Orange County area. Many of the participants use loops.

The most popular 6 meter loop is the low-cost Army surplus AT-339/PRC (see photo). Ruggedly built for field use, it tunes 38 to 55 MHz with a built-in attenuator for strong signals, and a sense circuit to resolve the back/front ambiguity. You can find other models with a little scrounging, including the older AT-249/GRD, which also covers the same range. The AT-340/PRC looks just like the AT-339/PRC, but it's for 20 to 39 MHz, making it suitable for 10 and 11 meter use.

What's Better Than a Loop?

In summary, a loop is a poor performer for serious RDF work above 100 MHz. In future columns, we'll look at the methods that top-notch hunters use on the VHF bands, including beams, switched antennas, and dopplers. We'll compare their performance in a variety of hunt situations.

If there's a T-hunt topic you'd like to see covered, please drop me a line. I am also eager to hear about hunting activities in your area. ■

ATV

Ham Television

Mike Stone WB0QCD
PO Box H
Lowden, IA 52255

ATV for Weather/Packet Public Service

The ATV mode can be especially helpful in aiding already established weather storm alert and emergency weather nets commonly held on 2 meters across the country. All our local amateur weather spotter nets were doing an admirable job over the years, protecting and serving local law enforcement and city/county officials with storm spotting information updates. Many of the amateurs realize that they lacked professionalism in two areas: 1) passing witnessed "spotter" messages and sightings on to nearby counties and states, and 2) getting advanced early warnings to all affected areas, prior to establishing the weather watch spotters nets.

Two years ago, our BRATS ATV club installed on our remote transmitter and repeater system (N9CAI ATV/RT/R) a *Kavorus* Color Weather Radar feed for 910 MHz. We obtained this feed from a local NBC TV station (KWQC-TV) which employs a couple of our ATV club members. We got permission from The Kavorus Company in Minnesota for just such a non-public view feed. These feeds and other types of radar services, including Doppler, are available in many area TV and radio stations or at National Weather Service facilities. They are also available at some commercial business facilities, such as local Airport Flying Services or other business that use weather radar equipment. Once a weather radar feed source is captured on the ATV repeater or remote transmitter, your ATV system will blossom with new interest, members, and public service projects!

EARWARN

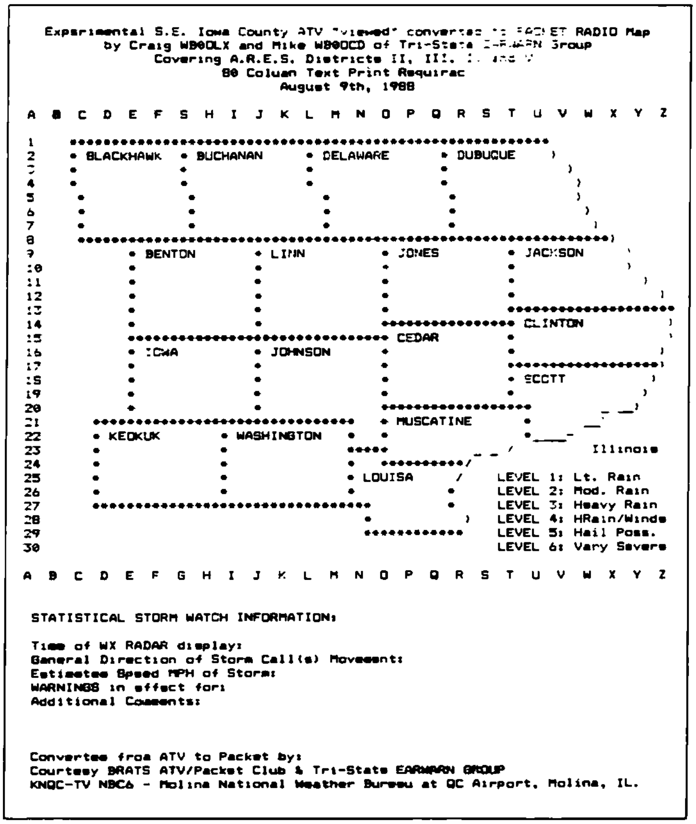
We established a brand new inclement weather early warning group that comprised county-appointed ARRL EC and assistant ECs, RACES personnel, county and state disaster services officials, local and county law enforcement department, ESDA directors, and weather observers. The basic purpose of this new group was to provide early warning and storm advancement information to all the local weather spotter nets. We chose a wide-range, hardly used, quiet 2 meter FM repeater (in Maquoketa on 147.06 MHz), to conduct our meetings and nets rather than interfere with the ongoing local weather spotter nets. Assigned members from these nets come to our frequency most of the time and thus report back into their own nets with updated information. We also hold a regular Sunday evening *EARWARN NET* at 9:30 PM after all other local nets are over. This new group met monthly at different locations to get things established, and eventually voted for quarterly meetings. We have our own newsletter—*Take Cover*—funded by donations from other local amateur radio clubs and groups.

The Tri-State EARWARN Group works this way: Members of the local Fast Scan gang observe incoming inclement weather on a regular basis on the ATV weather radar feed. Once bad weather threatens, packet radio beacon messages (145.01 MHz) are sent to designated EARWARN relay digipeaters in the projected path of the storm. We also go on FM voice to several of the local 2 meter repeaters in the area and announce what is happening to local EC or RACES personnel. The ATV radar feed and television transmitter is "locked on" for all to see during the entire span of the storm period. Packet radio beacon (unconnected) messages are constantly sent up through the digi relay stations. We also man the mentioned *EARWARN* 2 meter FM frequency for general WX related talk discussions and updates.

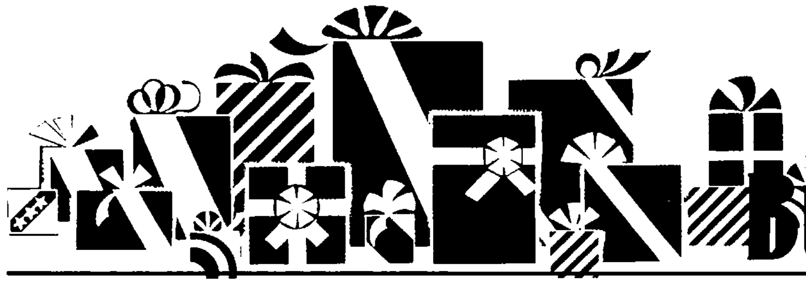
We are doing something on packet radio that relates to the used FSTV mode and is quite interesting and perhaps a "first" for packet use around the country. We designed a video screen map of Iowa and Illinois counties and placed around this map (across the top), an A–Z and (down the left side), 1–20 numbered grid reference index for marker indicators. We distributed copies of these maps at meetings and may also sit on local BBSs for packet operators to download and print out on their own personal computers. (We have, by the way, a *KA Node* designated weather BBS established (K0OQP-3) that takes and stores all weather-related messages, announcements, maps, charts, etc.) At the ATV radar viewed station, and with these maps stored on disk files, the packet maps are filled in with XXXs and various NWS storm warning level indicators (222, 333, 444, etc.) on the TV screen as to exactly where the inclement weather is located. Then this now updated, filled-in packet information map is sent over packet, or, on voice, is described in exact detail using the provided A–Z and 1–30 grid locators. Even those in the net without ATV capability then has on paper a map showing where the inclement weather storm cells sit. This hardcopy is especially useful for passing on to County Radio and Disaster Services Officials for their judgments and decisions. The officials now have something to back up their decisions which may be controversial by the public after the storm period passes. All maps also include, among other information, lower page time, direction of storm, and estimated storm movement speed. There's nothing like hardcopy evidence of Level 5 and 6 intensity build-ups to set storm warnings in action!

The work of being able to harmonize several Amateur Radio Groups together for inclement weather situations (ARRL District DEC), is similar to the job of a county disaster services director. It is important to understand the operations and needs of all of the local groups who are all trying to accomplish the same goals. ATV radar is the vehicle to do it. It is up to someone, or some newly established *EARWARN* type group, to take charge and blend these groups and services.

For more information on this type of service, the *EARWARN Take Cover* newsletter is available. Send $1 and your SASE to Kurt Johnson K0OQP, c/o Cedar County ARC, Cedar County Courthouse, Tipton, Iowa 52772. ■



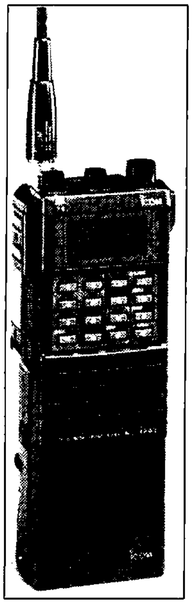
Map obtainable from packet radio on which observers plot the location and movement of storm cells.



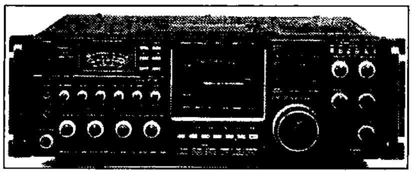
Holiday Buyers Guide

ICOM

The IC-32AT 2m/70cm dual band hand-held is new from ICOM. It is a full-featured HT. The 32AT has five watts of power output on UHF, and five and a half watts out on VHF. It has out-of-band reception (138–174 MHz and 440–450 MHz). The 32AT also has full duplex capabilities when the two channels are in different bands.



There are also many memory features. The 32AT has 40 simplex memory channels, that allow storage of up to 20 duplex frequencies. Each independent memory stores frequency, offset, and subaudible tone. It also has programmed scan. The memory scans all the channels except the one you have locked out. The optional UT-40 tone squelch unit monitors busy channels and beeps and flashes when the subaudible tone is received. By pushing the monitor switch, you can check the repeater output. All ports have rubber plugs that insert into them when they are not in use. The IC-32AT also has priority watch, that monitors the call channel every five seconds while operating on another frequency. The IC-32AT is available for $629. For more information, circle Reader Service number 230.

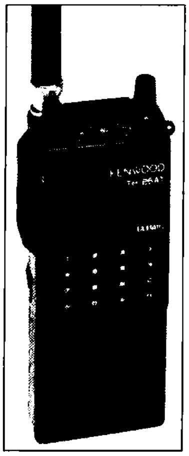


The IC-781 HF base station transceiver operates all modes and bands 160–10 meters, and receives continuously from 100 kHz–30 MHz. Its prominent feature is a band spectrum scope that displays signals in a 50/100/200 kHz range of the operating frequency. This all displays on a built-in five inch CRT screen. This screen displays frequencies, modes, memory contents, operating notes, RIT, two memo screens, and subdisplays for Packet and RTTY. The IC-781 also features dual band watch, twin passband tuning, 99 tunable memories, all wide and narrow filters, direct keyboard frequency entry, 150 watts output, built-in power supply, dual noise blanker, five multi-function timers, and two internal clocks.

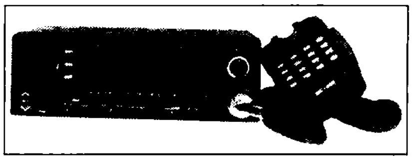
Suggested retail for the 781 is $5,995. For more information on this and the IC-32AT, contact *ICOM America, Inc., Corporate Headquarters, 2380 116th Ave. NE, PO Box C-90029, Bellevue, WA 98009-9029; 206-454-8155.* The Reader Service number is 229.

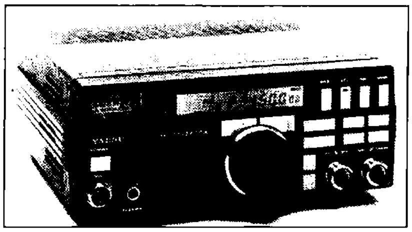
KENWOOD

The new TH-25 2 meter hand-held is similar in size to the BT hand-held series. The TH-25 puts out 5 watts on the high setting. The frequency coverage of the TH-25AT is 141–163 MHz (RX) and 144–148 MHz (RX and TX). It has a front panel DTMF pad and 14 memories. Other features include automatic offset selection, multi-function LCD display, rotary dial for memory, tone alert for quiet monitoring, band and memory scan, automatic power-off circuit, and a CTCSS encode/decode unit (optional). It is also water-resistant. The price is $329.95.



The TM-621A is the first 144/220 MHz FM dual-bander. It includes a dual channel watch function, selectable full duplex operation, 30 memory channels, extended frequency coverage on receive (138–174 MHz and 215–230 MHz), large multi-color LCD display, and programmable scanning. The 621 outputs 45 watts on 144 MHz and 25 watts on 220 MHz. Also included is an automatic offset selection on both bands, and dual frequency display for "main" and "sub-band" with automatic band changes. The suggested retail price is $700. For more information contact *Kenwood USA Corporation, Communications and Test Equipment Group, 2201 E. Dominguez Street, Long Beach CA 90810; 213-639-4200.*

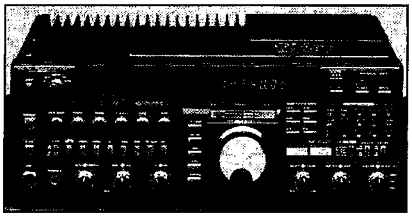




YAESU

The FT-747GX is a compact SSB/CW/AM and FM (optional) transceiver outputting 100 watts PEP on all HF amateur bands. It also has general coverage reception continuously from 100 kHz to 30 MHz. Features include operator selectable coarse and fine tuning steps optimized for each mode: 25 Hz and 2.5 kHz for SSB and CW, 1 and 10 kHz for AM, and 5 and 12.5 kHz for FM (with the optional FM board).

The 747GX has a dual VFO, along with 20 memory channels, which also store mode. You can choose frequencies, too, over which the scan skips. Scanning can be set for auto-resume. Memories are selectable from the microphone UP/DOWN keys. Eighteen of the memories can also store independent transmit and receive frequencies for non-standard split-frequency operation. Suggested retail price is $890. Circle Reader Service number 228 for more information.



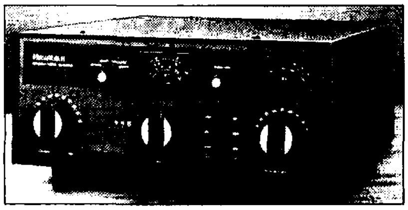
The FT-767GX from Yaesu receives from 100 kHz to 30 MHz continuously and transmits on all HF amateur bands. The receiver design is an upconverting triple superheterodyne. The PLL includes a modular temperature-compensated crystal oscillator (TCXO), to minimize frequency drift.

Features include memorized programmable tuning steps for each mode, from 10 Hz to 100 kHz; digital wattmeter and auto-calculating SWR meters; and selectable VFO tracking, where both VFOs tune together (for convenient repeater operation). Ten memories include modes and a check function, by which memory contents may be displayed without affecting simultaneous operation on a VFO. There is also band, memory, and limited band scan.

The FT-767GX has a built-in automatic

antenna tuner. The automatic HF antenna tuner includes one memory per band. The contents of this memory automatically returns the settings to their previous positions for quick settings when changing bands.

Suggested retail price is $1,930. For more information, contact *Yaesu USA, 17210 Edwards Road, Cerritos CA 90701.* Circle Reader Service number 227 for more information.

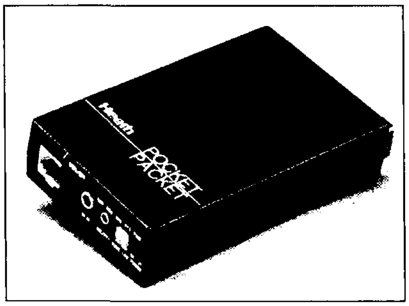


HEATH

Heath's new SA-2060A deluxe antenna tuner will effectively tune and match balanced or unbalanced feedlines and single-wire and ladder lines up to 1 kW, on the 160–10 meter bands.

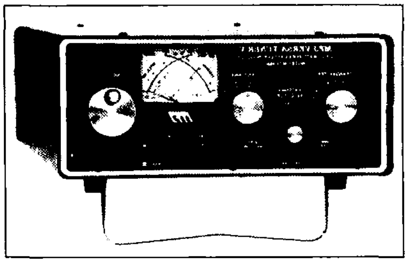
It features a dual wattmeter, single switch antenna selection, and total front panel control. With a single switch, the user can select a dummy load, or any of three permanently connected antennas, including a long-wire antenna.

Dual wattmeters read both forward and reflected average power, and in two ranges. The wattmeter section of the antenna tuner installs directly into a transmission line to measure the power on all frequencies between 1.8 and 30 MHz. It measures output up to 200/2000 watts in the forward direction and up to 50/500 watts reflected. The antenna tuner handles power input up to 2000 watts PEP on SSB, and 1000 watts on CW. The suggested retail price is $270. Circle Reader Service number 226 for more information.



Heath's HK-21 Pocket Packet TNC is the latest and smallest TNC available.

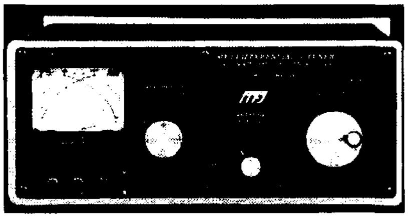
If your hand-held transceiver uses a mini phone jack for speaker output and a sub-mini for microphone, you can immediately connect the transceiver to the Pocket Packet unit at any time with the two shielded cables supplied. The HK-21 includes a built-in mini bulletin board. The HK-21 requires a 9 to 13.8V supply at 40 mA nominal current. The price is $219.95. For a free catalog and more information contact *Heath Company, Dept. 011-652, Benton Harbor MI 49022.* For this product, circle Reader Service number 225 for more information.



MFJ ENTERPRISES

The 3 kW Versa Tuner Model MFJ-989C is a full-featured HF antenna tuner. It has two large transmitting variable capacitors that can withstand 6000 RF volts. The 250 pF cap gives an extremely wide matching range, even on 160 and 10 meters. It also has a roller inductor. A three digit turns counter and a spinner knob give precise inductance control. You can use this tuner from 1.8 to 30 MHz, including MARS and all the WARC bands.

Retail on the MFJ-989C is $349.95. For more information contact circle Reader Service number 224.



Also from MFJ Enterprises is the new MFJ-986 2-knob 3 kW Differential-T Antenna Tuner with peak and average reading cross-needle SWR/wattmeter. The T-network tuner uses a single differential capacitor in place of two variable capacitors. It covers 1.8 to 30 MHz continuously, including MARS and all the WARC bands. The user adjusts only two controls. The MFJ-986 is broadband, which eliminates constant retuning. A three-digit turns counter plus spinner knob gives precise inductance control.

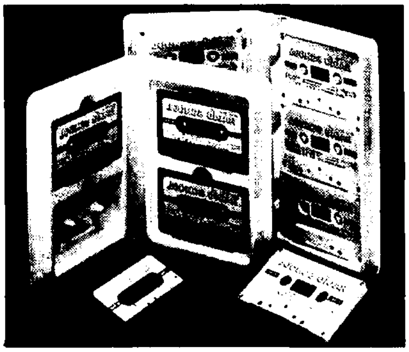
A lighted two color peak and average reading cross-needle SWR/wattmeter lets the user read forward and reflected power and SWR. It also has a new directional coupler that gives more accurate SWR and power readings over a wider frequency range. The six-position antenna switch lets you select two coax lines and/or random wires (direct or through tuner), balanced line, and external dummy load.

A new current balun for balanced lines reduces feedline radiation that causes RF in your shack, field pattern distortion, and TVI. Ceramic feedthrough insulators for balanced lines withstand high voltages and temperatures. The new MFJ-986 3 kW Roller Inductor Differential-T Antenna Tuner comes with MFJ's one year unconditional guarantee. The suggested retail price is $239.95. For more information contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State, MS 39762; 601-323-6551.* Circle Reader Service number 214 for additional information.

GORDON WEST RADIO SCHOOL

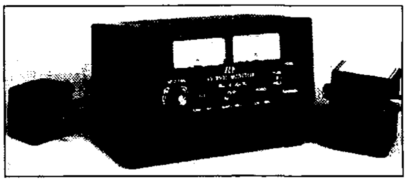
Gordon West Radio School offers cassette theory courses for the following amateur radio license categories: 1) Novice–two cassette theory and two cassette code; 2) Technician–four cassette theory and textbook; 3) General–four cassette theory and textbook; 4) Combination Tech/General–four cassette theory and textbook; 5) Advanced–four cassette theory and textbook; 6) Extra–four cassette theory and textbook.

Each theory course features the new revised question pool that parallels the actual VEC-administered examination. Questions are covered on the cassettes in the same order as they are in the book.



Visually impaired will especially appreciate the fact that this course can be followed without any visual aids. The included textbook assists, however, in better understanding some schematic diagrams and block diagrams.

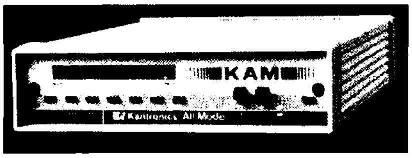
Each cassette course with its accompanying textbook is $19.95, plus $2.50 postage and handling, when ordering directly from Radio School. For more information write: *Gordon West Radio School, 2414 College Drive, Costa Mesa CA 92626; 714-549-5000.* Reader Service number 223.



WILLIAM M. NYE CO.

The Nye RF Power Monitor System contains many features. It gives peak, average, or peak and hold readings at a flick of a switch It has a sample and hold analog memory circuit capable of displaying for up to 20 seconds the correct peak power readings of a single 1 ms pulse. The power monitor automatically switches power scales to 5 kW. It has a built-in adjustable ALO. It comes with a directional coupler that goes in-line with the coax, and is connected to the meter with a four-conductor flexible cable. This lockout circuit for your amplifier will operate from either SWR or reflected power. It uses heavy duty relays with isolated contacts rated at 5 A at 120VAC/28VDC. The monitor is available in two models, the RFM-003 and RFM-005, which differ only in

wattmeter scaling. The models are priced the same at $297, and backed by the Nye full two-year warranty. For more information, contact: *William M. Nye Company, 1614 130th Ave. NE, Bellevue WA 98005; (206) 454-4524.* Circle Reader Service number 222.



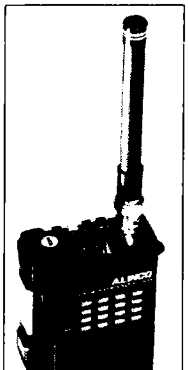
KANTRONICS, INC.

Kantronics has combined the features of the KPC-2 and UTU-XT to create a true All-Mode unit, the KAM (Kantronics All Mode). It functions with VHF packet, CW, RTTY, ASCII, and AMTOR.

KAM features HF and VHF radio ports, simultaneous HF and VHF packet connects, digipeating, and VHF/HF gateway.

KAM also features bargraph tuning, user-programmable Mark and Space tones for RTTY and HF Packet, and limiter/limiterless operation on HF for weaker signal operation. KAM's separate CW demodulator is also center frequency and bandwidth programmable. The price is $319. For more information contact: *Kantronics, Inc., 1202 E. 23rd Street, Lawrence KS 66046.* Circle Reader Service number 221 for additional information.

ALINCO



Alinco Electronics, Inc., has introduced the DJ-100T hand-held 2 meter transceiver. The DJ-100T puts out about 3 watts in the high-power mode. A number of accessory batteries are available, which will supply up to 6.5 watts of output power.

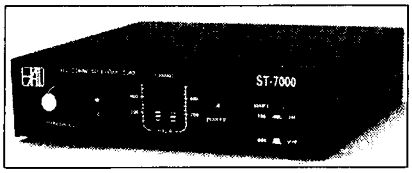
The DJ-100T has a frequency coverage of 144–148 MHz, and is easily modified for CAP and MARS simplex operation. Also included are 10 memories, automatic battery saving feature, a function and frequency lock, and a subaudible tone encoder.

The price of the DJ-100T is $299. For more information on this product, contact: *Alinco Electronics, Inc., 20705 S. Western Ave., Suite 104, Torrance CA 90501; 213-618-8616.* For additional information circle Reader Service number 220.

HAL COMMUNICATIONS CORP.

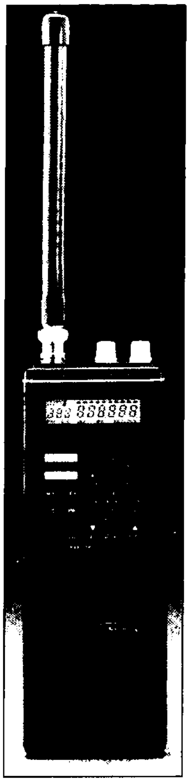
The ST-7000 is specifically designed for 300 baud HF packet. Techniques developed for the government and military ST-8000 (MD-1232/G) HF Modem are applied in the ST-7000 for the unique problems of high frequency packet radio operation.

AGC-controlled AM signal processing is used, providing a very wide dynamic range. All filters and detectors in the ST-7000 are optimized for 300 baud HF packet. The user has the choice of two modes: the standard 200 Hz shift mode, and the 600 Hz shift mode. Both shifts are fully supported by separate optimized 6-pole input filters and a 40 dB AGC system. The standard 200 Hz shift mode uses an optimized phase-locked loop (PLL) detector, whereas the more optimum 600 Hz shift mode uses separate 4-pole Mark/Space filters, active detectors, and a 3-pole post-detection filter. The transmit tone generator uses a proven crystal-based sine-wave synthesizer circuit to assure minimum phase distortion and spectrum splatter. The ST-7000 has three different packet controller (TNC) interfaces: RS-232C, TTL, and TNC Audio, making it fully compatible with all existing packet controllers on the market.



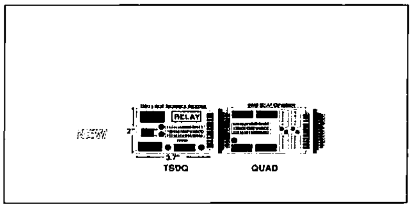
ST-7000 operates from +11 VDC to +15 VDC at .25 A. It is available for $299 from *Hal Communications Corp., Government and Commercial Products Division, 1201 West Kenyon Road, PO Box 365, Urbana IL 61801-365; 217-367-7373.* Circle Reader Service number 219 for more information.

UNIDEN



The new Regency R-4030 Programmable hand-held Scanner has many features. Among them are 800 MHz coverage with 12 bands including 806–956 MHz; 200 channel capacity; 10 priority channels to keep a close watch on up to 10 channels; 10 channel banks to store frequencies for convenient use; rechargeable batteries with a detachable battery pack; weather search to find the NOAA weather channel that is active in your area; keypad lock; channel lockout to lockout unused or busy channels to concentrate on others; and a track tuning feature that gives perfect tuning on every channel for crystal clear reception.

The R4030 is available for $399 from *Regency, Uniden Corporation, 4700 Amon Carter Blvd., Ft. Worth TX 76155.* Circle Reader Service number 218 for additional information.



ENGINEERING CONSULTING

The new Model TSDQ four digit sequence decoder replaces the popular TSD decoder and adds several new features, including a DPDT 2 A relay, on-board 5 volt regulator, and digit valid indicator and expansion connector. Board connections are via a 24-pin card edge connector, which provides quick disconnect and the added feature of expansion with the new Model "Quad" four relay expansion card.

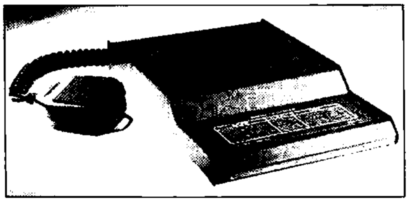
The TSDQ operates as a stand-alone two to four digit touch-tone sequence decoder. The output may be either latching or momentary control of the DPDT relay. All 16 digits output to the card edge connector and can be used for single digit commands. The relay is turned on with a four digit code and relays which may be turned off with individual access codes. A master on code followed by the relay will turn on a relay while a master off code followed by the relay number turns the relay off. These relay on/off codes can be a total of three to five digits in length. In addition to the relay outputs, there are four transistor outputs that can be used to provide LED read-outs of the relay states, or as control voltage for other devices. All output connections are via a 24 pin card edge connector using the same pin numbers for all inputs as the TSDQ card. This allows instant compatibility when adding the Quad expansion card.

The TSDQ and quad specifications are: +8 to +20 VDC of power, 200 mV–3 VAC of audio, 2 amp double pole relay for output TSDQ, 16 individual digits (0–5V), and 2 A 4DP relays for logic output quad is four double pole relays with 2 amps. The price for the TSDQ is $79.95 and the price for the Quad is $99.95. For more information contact: *Engineering Consulting, 583 Candlewood Street, Brea CA 92621; 714-671-2009.* Circle Reader Service number 217 for additional information.

NEL-TECH LABS

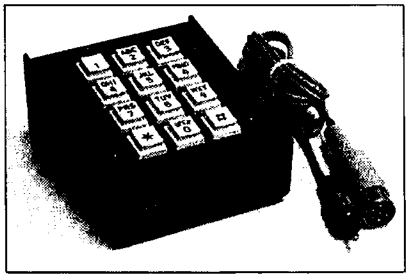
The NTL Digital Voice Keyer (DVK-100) is a state-of-the-art microprocessor controlled digital voice storage and announcement system. It has been designed specifically for amateur radio communications and represents the latest technology in audio processing.

The DVK-100 provides four independently selectable, variable length, voice storage memories. It also contains a built-in selectable audio amplifier capable of driving an external 8Ω speaker, with mute and high/low level



control. It also includes a selectable audio compressor and end of transmission tone generator have been included.

The DVK-100 is virtually compatible with all transceivers. It will accommodate both dynamic and condenser mikes and both positive and negative PTT transceiver inputs. The DVK-100 suggested retail price is $260. For more information contact *Nel-Tech Labs, Inc., PO Box 1030, Londonderry NH 03053.* Circle Reader Service number 216.



STONE MOUNTAIN ENGINEERING CO

Stone Mountain's KW-QSYer for Kenwood rigs provides high speed keying and easy frequency selection. Its full-size keypad is inclined at a 10 degree angle for comfort as well as speed. It is popular with contesters and blind operators. It has an internal speaker that sounds a different tone for each key. The KW-QSYer works with the TS-940 series (with the Kenwood IF-10B interface), the TS-440 series (with the IC-10 interface), the TS-140 series (with the IF-10C interface), the TS-711/811 series (with the IF-10A interface), and requires an 8–16V, 100 mA, external DC supply. The sister models are available for the 757GX, 757GX-II, 767GX, and the IC-735. Priced at $89.50 plus $2.50 shipping. A companion 12-volt DC wall supply for the KW-QSYer is $10. For more information contact *Stone Mountain Engineering Company, Box 1573, Stone Mountain GA 30086; 404-879-0241.* Circle Reader Service number 215.

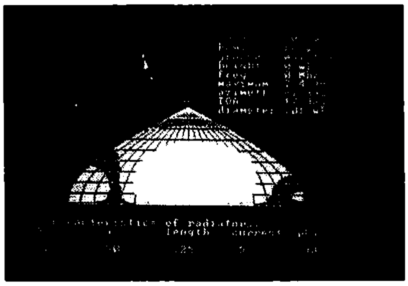
CALL SIGN CUPS

Call Sign Cups will personalize 10 oz. coffee mugs and/or 15 oz. beer mugs with your call sign. Ceramic decals are placed on stoneware mugs. They are machine washable and microwave safe. The prices are $5.95 for the coffee mug and $7.95 for the beer mug, plus shipping and handling. Quantity discounts for clubs are available. For more information contact *Call Sign Cups, PO Box 17062, Raleigh NC 27619.*

EPSILON COMPANY

Epsilon Company announces Vertical Pro, software that enables you to design medium wave and short wave vertical arrays. By modeling several possible antennas before building, you can decide what to build on an objective basis. Vertical Pro gives you the capability to design your own at an affordable price. Modeling the antenna first will stimulate creativity in finding better solutions given limited resources.

The Vertical Pro gives a sinusoidal projection of the radiation pattern. This is a flat projection of the three dimensional radiation pattern, color coded according to signal intensity. The projection can be explored with a mouse or cursor keys and the gain can be read at a particular azimuth and take off angle in a window below. Antennas modeled with Epsilon's software can be modeled over your choice of ground types such as: sea water, fresh water, moist, average, or dry earth. The projection is displayed in the center of the screen, the original grid is on the upper left, and a report is on the upper right. By moving the cursor over an element on the grid, the resistance, reactance and element parameters are displayed on the bottom. Moving the cursor over the sinusoidal projection will display the gain at a particular take-off angle and azimuth.

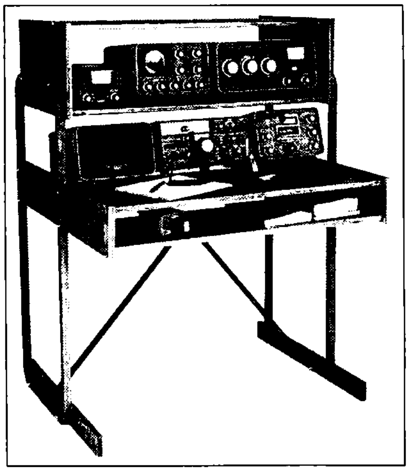


Epsilon software runs on IBM-PCs and compatibles with at least 256K (640K recommended), DOS 2.0 or higher. CGA or EGA needed. The programs can make use of a 8087/80287 math co-processor and a mouse.

Vertical Pro sells for $80 plus $5 for international shipping. Order by sending a US check or international money order in US dollars to *Epsilon Co., PO Box 715, Trumbull, CT 06611; 203-261-7694.* Circle Reader Service number 213 for more information.

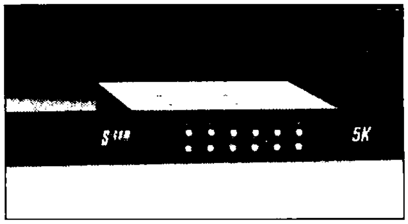
S-F AMATEUR RADIO SERVICES

The S-F Radio Desk STD-36, from S-F Amateur Radio Services, eliminates clutter by providing enough space for a complete radio station. It has enough space for antenna tuners, VFO, CW keyers, filters, telephone, and log books. It will support over 200 pounds. It comes as a quick-assemble kit. The rear shelf is angled at 15 degrees for better viewing of the displays. The S-F Radio Desk is 50" high by 39" wide. The suggested retail price is $200. For more information contact: *S-F Amateur Radio Services, 4384 Keystone Ave., Culver City, CA 90230; 213-837-4870.* Circle Reader Service number 212 for more information.

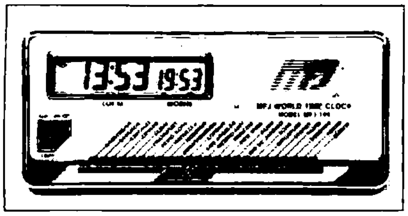


S-COM INDUSTRIES

S-COM Industries introduces an option display cabinet for the S-COM 5K repeater controller. This cabinet may be retrofitted to the 5K controller without soldering or rewiring. The front panel is made with non-chipping black anodized, with white graphics and hidden fasteners. The red Hewlett-Packard AlGaAs LED lamps inform the viewer of important circuit status data, e.g. receiver COR, transmitter PTT, CTCSS decoder, control receiver COR, DTMF data valid, power on, logic inputs 1, 2, and 3, and logic outputs 1, 2, and 3. These LED lamps draw only 1 μA each.



A conductive iridite-plated chassis box reduces RFI and houses the 5K board, display board, and an optional audio delay module. The cabinet provides cutouts for the 5K's power and input/output connectors, and uses PEM fasteners to eliminate troublesome nuts and standoffs. A ribbon cable assembly attaches to connectors located on the 5K and display boards, making for easy installation. The assembled and tested display cabinet is priced at $69 plus $5 shipping and handling. A similar cabinet is available without the display feature. Contact *S-COM Industries, PO Box 8921, Fort Collins, CO 80524; 303-493-8316.* Circle Reader Service card number 211 for more information.



MFJ ENTERPRISES

MFJ Enterprises Inc. has a new MFJ-109 World Time Clock. This clock features a sliding indicator you can set to learn the times of any of 24 international cities. It has a 24-hour world time display and a local time display. The LCD characters are ⅛" high.

The MFJ-109 also has a Greenwich Mean Time (GMT) pointer for instant access to the international standard. Other features include alarm with snooze, night light, daylight savings time adjustment, date change indicator, suede-like carrying case, and flip stand. The MFJ-109 World Time Clock comes with a one year unconditional guarantee. Price is $18.95. For more information, contact *MFJ Enterprises Inc., PO Box 494, Mississippi State, MS 39762; 601-323-5869. Call 800-647-1800 to order.* Circle Reader Service number 210 for additional information.

SIBEX INC.

The VR-1 is one of the new lines of portable test equipment from Sibex Inc. The VR-1 is a battery-powered voltage calibrator. The user can select its output from 10 mV to 10 V in a 1-2-5 sequence, using the 11 position switch Both + and − voltages are available at the output terminals. The front panel has a low battery indicator. The VR-1 can be used for equipment servicing and calibration, R&D work, instrument calibration, and recorder calibration, to name a few applications.

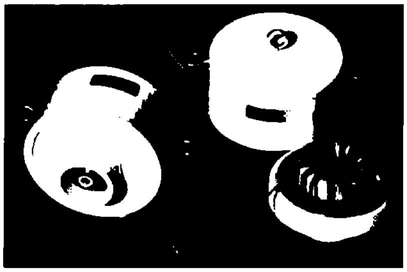
It is housed in a pocket sized plastic case, shaped for convenient holding. The power is supplied by a standard 9V battery contained within the case. VR-1 is available from stock at $89.95. For more information, contact *Sibex Inc., 1088 Kapp Drive, Clearwater, FL 34625; 813-441-8525.* For additional information, circle Reader Service number 209.

CUSTOM TECHNOLOGY

Custom Technology now offers a line of wideband RF BALUN antenna auto-transformers. The transformers match unbalanced loads (coax) to balanced loads (antennas and ladder transmission lines).

The BALUNs are rated at 2 kW (PEP) from 1.8 to 30 MHz continuous. The cores are powdered iron toroidal types covered with glass tape. Windings are high isolation magnet wire to ensure maximum performance without breakdown even when subjected to high SWR conditions.

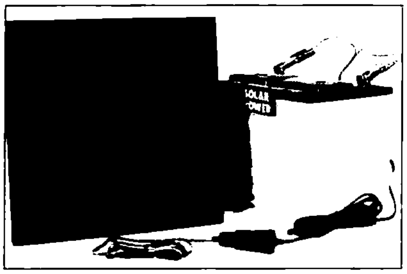
Available ratios are 1:1, 1:4, 1:6, and 1:9. Coaxial termination is made with a UHF SO-239 receptacle. The coaxial connection is housed in a PVC cover. An "N" type receptacle is available at extra cost as a special order. The 3" x 4" BALUN is made of cadmium steel; the termination is made of flexible copper braid. The complete BALUN assembly is potted in epoxy backfill for ruggedness. The price for each BALUN is $25. Multiband antenna kits are available for $35 each, plus $3 for shipping and handling. Product literature is available on request from *Custom Technology, 8385 Locust, Kirtland OH 44094.* For more information, circle Reader Service number 208.



SCOOTER PRODUCTS

Scooter Products' Model SP4M Guard-It™ Surge Protected Outlet Strip protects modular FAX, modem, and electronic equipment and peripherals from surges and noise. Model SP4M has an anti-static grounding jack for your anti-static accessories, such as touch pads and screens. There is full MOV protection on the power sockets to protect your equipment.

Model SP4M handles peak surge currents up to 6000 amperes with a clamping time of less than 1 nanosecond. In addition to a master on-off lighted switch, the Model SP4M has a surge failure light which indicates abnormal voltage or noise. This UL listed unit includes a resettable circuit breaker and a six-foot heavy duty cord. The Model SP4M Surge Protected Outlet Strip is $89.95. *Scooter Products, Ohm/electronics, Inc., 746 Vermont St., Palatine IL 60067. 800-323-2727 (Illinois, 312-359-6040); FAX number is 312-359-9686.* For more information, circle Reader Service number 206.



SOLAR ELECTRIC

Hams and other radio operators can keep their batteries fully charged with Solar Electric's new line of solar battery chargers. Measuring only a few feet square, the Maintainer 2 model is portable enough to bring almost anywhere. The panels will keep storage batteries charged on-site, or power the devices directly during daylight hours. The new generation of solar panels are also more sensitive to low light levels and more efficient in high temperature sites. The Maintainer 2 is available for $89.95. For technical details, write or call *Solar Electronic, 175 Cascade Court, Rohnert Park, CA 94928; 800-832-1986 or 707-586-1987.* Circle Reader Service number 205 for additional information.

AERIAL VIEW

Antenna News

Arliss Thompson W7XU
RR 3, Box 224
Sioux Falls SD 57106

Transmission Line Transformers

The column covering transmission line transformers in the August 1988 issue of *73* generated more feedback than any previous installment of *Aerial View*. This month's column will be devoted to answering some questions and making comments of general interest to all readers.

Many attempted to run the BASIC program listed in that article, but had problems with it. Readers alerted me to several problem areas. Joel WB0ΩGF pointed out two errors in the program listing. First, there are two lines numbered 220. Change the first line number to 200. The second error in the listing is in line 470. In this line, change "nad" to "and."

A number of persons complained that, while they were able to get the program to run in the quarter-wave transformer mode, they ran into difficulties when they used the series section mode. The general theme seemed to be that, in the program, the impedances of the matching section and the main transmission line were too close in value. Since some of these comments came from users of IBM clones and GW BASIC (the same version of BASIC that I use), the difficulty probably arose from constraints imposed by the program and its equations.

Impedance Values

Recall that the impedance of the matching section cannot be too close to that of the main transmission line. Program lines 230–280, and line 340, involve some calculations that determine if those two impedances are too close in value. The general rule is to first calculate the SWR that would exist if the antenna and main transmission line were not matched. If the square root of that number is greater than 1, then the impedance of the matching section should be greater than the square root of the SWR multiplied by the impedance of the main transmission line.

Next, reverse the numerator and denominator in the SWR calculation. The impedance of the matching section is now acceptable, being less than the square root of the SWR times the impedance of the main transmission line. For example, say the antenna has an impedance of 200Ω and the main transmission line has an impedance of 50Ω. Without matching, the SWR would be either 4/1 (that is, 4:1) or 1/4 (normally SWR is calculated so that it is always greater than 1, but we must make an exception in this case).

The square root of 4/1 is 2. Therefore, the matching section must be greater than 2(50) = 100Ω, or it can be less than the square root of 1/4 times the main line impedance. With this example, that means that the matching section impedance would also be acceptable if its impedance was less than 1/2(50) = 25Ω. If you have difficulty with this, try working through the examples that appeared in the column. The answers in the examples were calculated by the listed program. If you have problems with the examples, check your listing for the above corrections.

BASIC Problems

An ever-present hazard of writing programs in BASIC is that different computers frequently use different versions of BASIC. For example, a BASIC program written on an IBM clone may not run perfectly on a Commodore machine. In fact, it may not run at all! Larry W8VLN wrote that his Commodore 64 consistently gave an error message when he tried to run the series-section portion of the August program.

Speaking of BASIC dialects, I know of at least one book which can help you translate different versions of BASIC—*The BASIC Handbook*, by David Lien (Compusoft Publishing, PO Box 19669, San Diego, California 92119; 1981). It may no longer be in print, but it might be available at your local library. Similar volumes may also be available from your local computer store.

Those readers with Apple II or IBM PC computers may be interested in an offer from Larry W1HUE. He wrote an improved version of this program in "Applesoft" BASIC as well as in PC-style BASIC. He also has another short program that calculates the design parameters for antenna traps made from coaxial cable. Larry will supply copies of both programs for $10 ($12 for overseas airmail) to cover the cost of the disk and mailing. They are available on either 3.5" or 5.25" diskettes in either IBM or Apple format (specify which). Write to Larry East W1HUE, 119-7 Buckland St., Plantsville, CT 06479.

Frequency Specific

Another question centered on transmission line transformer use in the field. One reader wanted to know what length of series-section matching transformer he should use to feed a multiband trap dipole. Unfortunately, series-section transformers are frequency specific; they work over a relatively narrow band of frequencies, such as an amateur band, but not on multiple bands. The same is true for quarter-wave transformers (a special case of series-section transformers), quarter- and half-wave baluns, etc. It's not possible to feed a multiband antenna through a single series-section transformer and obtain the correct impedance transformation on all bands.

Another reader asked whether series-section transformers function as baluns. The answer is no. A balun is a device that matches an unbalanced line (such as coax) to a balanced line or load (such as open wire line or a dipole antenna). Series-section transformers here *match impedances*. They could be coiled to form an RF choke type of balun, or ferrite beads could be slipped over the outside of coaxial series-section transformers to choke off currents flowing on the outside of the coax.

Ground Systems for HF Verticals

The recent column on ground systems and vertical antennas brought in some interesting questions. Let's see how your answers compare to mine.

Q. "The well-known manufacturer of my multiband trap vertical says that the antenna has minus 3-dB gain compared to a dipole. This is less than that of an isotropic antenna—can this be true?"

A. Keep in mind that a dipole has 2.14-dB gain over an isotropic antenna *only in free space*. Over perfect ground, an additional 6-dB of gain is possible (the direct and reflected waves reinforce each other); gain over real ground is less, but still important. Even if this gentleman's antenna has 3-db less gain than a dipole, it may still show gain over an isotropic radiator, particularly when over very good ground.

Now for the meat of the question: might a vertical be 3-db down from a dipole? Yes! A vertical with better than a fair ground system can easily be fifty percent or less efficient. Dipoles, on the other hand, are typically over 90 percent efficient. Of course, this analysis overlooks any differences in polarization, angle of maximum radiation, and so forth, but as a general statement, yes—a multiband vertical over fair to poor ground will probably be 3-dB or more down from a dipole.

Q "I have a horizontal monobander 18 feet above my roof. The roof is 13 feet above ground. Does my antenna think it is 18 feet above ground, or 31 feet up? Do wires running across the roof act as a ground?"

A This ham's antenna probably "thinks" it is 31 feet or so above ground, as far as distant communication is concerned. Radiation straight up may be reinforced by wires lying beneath the antenna, but that radiation will be of little use on the higher frequency bands. As the angle of radiation is lowered, the reflection point moves farther from the antenna. At low angles of radiation, the area of reflection for the antenna may be up to 10 wavelengths away.

If the roof were very large in terms of wavelength, there could be some ground effect from nearby wires lying beneath the antenna, though this is not likely in most suburban or rural locations. Note that these comments are directed with regard to a horizontal antenna. Also, the ground may not be RF ground. The point of reflection for signals typically does not occur exactly at ground level, but rather it is usually a few inches to a few feet below the surface. It is deeper in poor soil, and closer to the surface over highly conductive surfaces.

That's it for this month. Thanks to all of you who wrote with questions, comments, and suggestions. Due to my recent move, replies to some requests for information have been somewhat less than prompt, but any backlog will have been cleared by the time this appears in print. My apologies for any delays. Keep those cards and letters coming (with SASEs, please, for a reply). ■

Number 20 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

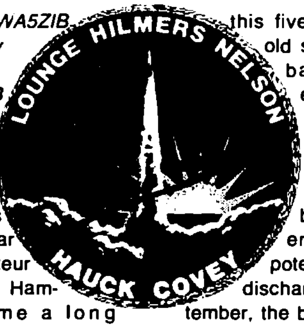


Photo B. Mission patch from STS-26: America's return to space.

A Great Year!

Wow! 1988 has been the best year ever for the amateur satellite program. Hamsats have come a long way since the launch of OSCAR 1 in December, 1961. Twenty-seven years ago, we had a single small transmitter in space sending "HI" in code as it circled the earth, until atmospheric drag took its toll a few short months later. Today the picture is much different.

For me, 1988 satellite activity started a few minutes after New Year's festivities had subsided. AMSAT-OSCAR 10 was up and running in Mode B (70 cm up and 2 meters down) with good access to Europe. After a leisurely conversation with G1IMM, a check of my satellite predictions showed RS-10/11 available with a pass to the west. WA6TKV and N6DGK were both ready with New Year's greetings for those on RS-11 Mode A (2 meters up and 10 meters down). Later that day, I tracked more RS-10/11 passes which yielded contacts all across North America. The UoSAT spacecraft, U-O-9 and U-O-11, were both sending telemetry and messages at 1200 baud on 2 meters. Fuji-OSCAR-12 was soon to be available with its digital packet-radio system bulletin board using Mode J (2 meters up and 70 cm down). Operation via the analog J transponder continued for voice communications. Things were looking good for 1988, and they only got better.

Those Still With Us

OSCARs 9, 10, 11 and 12 are still with us as the year comes to a close. U-O-9 continues with telemetry and bulletins. A-O-10 is available again for contacts as its orientation of its panels to the sun improves. The loss of control due to onboard memory degradation has not affected the Mode B transponder's performance. The only concern among those active on this five-and-a-half-year-old satellite is for the batteries. During each period of off time, when the satellite's panels are pointed away from the sun, the batteries experience serious and potentially damaging discharge. During September, the beacon was occasionally heard sending meaningless PSK, indicating that complete discharge could be causing system resets at low voltage levels. As long as the batteries hold on without shorting internally, A-O-10 with its high elliptical orbit may provide many more months, or even years, of service.

Earlier this year, U-O-11 performed admirably during the transpolar Ski-Trek operation involving a joint Canadian and Soviet group of skiers. This University of Surrey satellite is now back to its normal activities with the digital communications experiment, radiation measurements, and digitalker synthesized voice transmissions.

F-O-12 still suffers from its negative power budget. The systems require more electricity than the solar cells can provide. The schedule of digital and analog transponder activity alternates with recharge days to keep the batteries up. The JARL (Japan Amateur Radio League) has provided satellite itineraries as much as a month at a time, though. This has helped remove the guesswork from F-O-12 operation. It is no longer necessary to listen for a pass in hopes of finding an active transponder. AMSAT North America forwards the schedule updates every week via HF and satellite nets, and also publishes them in *Amateur Satellite Report*, the bi-weekly newsletter for members.

RS-10/11 seems to be stuck. For 1988 there has been no RS-10 operation, and Mode T (15 meters up and 2 meters down) has not been heard via either unit. For the year, we have had Modes A and K (15 meters up and 10 meters down) via RS-11. Mode A has been active continuously, while K can be used on weekdays. Uplink sensitivity is still excellent and downlink signals are strong. The auto-transponder, ROBOT, has been calling CQ on 29.452 MHz every day. Many stations have received QSLs for ROBOT contacts. Unfortunately, they are old RS-5/RS-7 cards with RS-10 or RS-11 handwritten over the old satellite names.

AO-13 Settles In

On June 15th, A-O-13 joined the club of active hamsats. After several months of great contacts, system tests and flawless ground control, the verdict is in. This is the satellite for which we've been waiting. With A-O-10 still performing well when properly illuminated, we now have two Phase 3 type (high-orbit and long-life) satellites.

Thousands of stations are set up for Modes B and J. A few hundred are on Mode L (23 cm up and 70 cm down), and a few dozen have been on the air via Mode S (70 cm up and 13 cm down).

During September, tests were run on the Mode S transponder. The beacon frequency was quite different from previous announcements and charts, but the transponder limits were close. The average Mode S station has 2 kW effective radiated power for the 70 cm uplink and a five-foot dish with a GaAsFET preamplifier for the 13 cm downlink. Due to the highly directional helix antenna on the satellite for the 13 cm downlink, you can only operate Mode S when the satellite's antennas are aimed directly at the earth. Short stretches of S activity have been scheduled in the middle of Mode L periods, another mode with highly directional characteristics.

Now that the satellite's circuitry has stabilized, accurate frequency lists have been made. Bob N5LCO composed Table 1 using data from AMSAT-NA and Bill McCaa K0RZ. Bill was the designer and project manager of the Mode S system.

Shuttle Activity

Amateur satellite enthusiasts around the world closely followed the launch, in-orbit activities, and the landing of STS-26. The mission did not carry any amateur radio equipment, but it represented a return to space for America and the potential return of ham-in-space activities on future shuttle flights.

Most hams recall the 2 meter activities of Dr. Owen Garriott

Photo A. RS-11 "re-made" QSL card.

W5LFL on STS-9 in December, 1983. Signals from Owen's HT and window-mounted antenna on 145.55 MHz were excellent. Ten years of planning had finally paid off. Earlier requests to place a ham rig on Skylab had been turned down.

During the summer of 1985, Dr. Tony England W0ORE on board the Challenger provided many scheduled voice contacts and excellent SSTV (slow scan television) transmissions from space. Even though there was little time for making casual contacts, the TV system was activated much of the mission.

In late autumn 1985, Spacelab mission D1 took two German amateurs and one Dutch ham to low-earth orbit on board the Columbia. Using the callsign DP0SL, this operation used 70 cm as an uplink with 2 meters as the downlink. A CQ message in Morse Code (F2 transmission) could be heard on 2 meters when the system was not used for voice communications. Listeners could then call on 70 cm (FM voice) in hopes of being heard by the DP0SL receiver and recorded on tape.

Columbia again played host to an amateur radio project in early January 1987. MARCE, the Marshall Amateur Radio Club Experiment, flew in a Get Away Special canister. Using a voice synthesizer, data from the alloy solidification experiment, the plant physiology experiment, and the crystal growth experiment, flowed to ground stations on 70 cm. The transmission frequency was set to match the uplink band of A-O-10, allowing linking of the transmissions through the satellite for those not able to monitor the signals from the payload bay directly.

Dr. Ron Parise WA4SIR will continue in the tradition of the previous amateur activities with SAREX-2 (Shuttle Amateur Radio Experiment number 2). In addition to voice contacts, Ron will have a packet radio system. It will be activated continuously to allow automatic contacts to be logged during times when the station is not manned. The ROM (Read-Only memory) software has been in a TNC (terminal node controller) and on the air from the Johnson Space Center with the callsign W5RRR.

Ron's mission was originally scheduled for March 1986. Now it is planned for March 1990. Other opportunities to fly the SAREX-2 equipment may come before then, but at least ham-in-space activity is on the NASA manifest. Till then we have four microsats, RS-12/13, JAS-1B, and two UoSATs waiting for their trips to space. While 1988 was great, '89 may be better yet. ■

AMSAT OSCAR-13 Phase 3C
Operating Modes and Frequencies

Mode JL

L Uplink	J Uplink	Downlink	Sum = 1705.356 / Sum = 580.413
1269.351 MHz		436.005 MHz	L passband upper limit
1269.361		435.995	
1269.366	144.423 MHz	435.990	J sub-band upper limit
1269.376	144.433	435.980	
1269.386	144.443	435.972	
1269.391	144.448	435.965	J sub-band center
1269.396	144.453	435.962	
1269.406	144.463	435.952	
1269.416	144.473	435.942	J sub-band lower limit
1269.421		435.935	
1269.431		435.925	
1269.441		435.915	
1269.451		435.905	
1269.461		435.895	
1269.471		435.885	
1269.481		435.875	
1269.491		435.865	
1269.496		435.860	L passband center
1269.501		435.855	
1269.511		435.845	
1269.521		435.835	
1269.531		435.825	
1269.541		435.815	
1269.551		435.805	
1269.561		435.795	
1269.571		435.785	
1269.581		435.775	
1269.591		435.765	
1269.601		435.755	
1269.611		435.745	
1269.621		435.735	
1269.631		435.725	
1269.641		435.715	
1269.731	RUDAK up	435.677	Engineering beacon/RUDAK downlink
		435.675	
		435.665	
		435.655	
		435.651	General beacon

Mode B

Uplink	Downlink	Sum = 581.398
	145.985 MHz	Engineering beacon
435.423 MHz	145.975	Passband upper limit
435.433	145.965	
435.443	145.955	
435.453	145.945	
435.463	145.935	
435.473	145.925	
435.483	145.915	
435.493	145.905	
435.503	145.895	
435.508	145.890	Passband center
435.515	145.885	
435.523	145.875	
435.553	145.865	
435.543	145.855	
435.553	145.845	
435.563	145.835	
435.573	145.825	Passband lower limit
	145.812	General beacon

Mode S

Uplink	Downlink	Diff = 1965.113
435.636 MHz	2400.769 MHz	Passband upper limit
435.635	2400.748	
435.630	2400.743	
435.625	2400.738	
435.620	2400.733	
435.619	2400.732	Passband center
435.615	2400.728	
435.610	2400.723	
435.605	2400.718	
435.602	2400.715	Passband lower limit
	2400.661	Engineering beacon

Mode B and Mode JL are inverting transponders i.e. up on LSB down on USB
Mode S in non-inverting i.e. up on USB down on USB

AMSAT OSCAR-13 Phase 3C operating modes and frequencies.

Number 21 on your Feedback card

LETTERS

From the Hamshack

73 Worldwide

As usual, *73* has always provided interesting articles and information. However, the days are gone when the magazine could be considered an "American" magazine. With its primary and secondary readership worldwide, the editorial slant ought to lay greater emphasis on the needs of hams worldwide.

J. Srinivasan VU2JX
Bangalore, India

Thanks very much for your kind comments on the magazine! 73 has always made a serious effort to stay in tune with hams worldwide. What other magazine devotes a monthly 3–4 page column to international ham affairs? This represents a minimum *of 7–8% of our editorial material each month. (Foreign subscriptions are only 5% of the total) If you are interested in becoming our Indian correspondent for "73 International," contact Richard Phenix here at 73 HQ ...de NS1B.*

No Code Rerevisited

I wish to express my appreciation for the useful data I have gleaned from *73*. I have only been reading it for one year, but I have already learned from your antenna articles how to get our mobile-to-base range up to about 30 miles on a good morning.

While I'm on-line, I'll put in a plug for a code-free VHF/UHF license. Some of us radio devotees have a good deal more to do than memorize things which we will use so seldom that we forget. This is a busy time in human history. I expect that there are a lot of us out here who could make a bit of time for vox ham, but who decline to (as we see it) waste the time to memorize, then forget, a language which is arcane and becomes increasingly archaic.

If radio is looking to the youth, it will have to offer them a twenty-first century—not 19th century—mode of operation.

J.R.Mainfort
Farmville VA

Thanks to the Maritime Net

I am currently serving with the US Navy in the Persian Gulf area. I would like to personally thank Fred W3WZU and Dick WB1BYN on the Maritime Mobile Net.

Once I was licensed as a ham, I have met quite a few extraordinary people who take their free time seriously to help out others in need. I was tasked to get priority calls through involving deaths, illnesses, and Easter greetings. With no phone for 57 days straight, people look for alternatives.

Thanks to all the net members on 14.313.

Bill Poulin KA4WWG/MM3
USS San Jose

Try 160!

Which BS is Bill W4TAL referring to when he says, "Sure don't care for the BS that clutters up the low bands... sure enjoyed the days when you could get into a good technical conversation with another amateur?" Sure hope he isn't referring to ME!

One reason I like 160 meters is that there IS plenty of technical conversation, and very few short rubber stamp QSOs.

Listen on about 1823 kHz any morning before work. There are some W4 stations talking computer technology EVERY DAY. Fascinating to listen to. And every evening there are a couple of hours of conversation about packet, AMTOR, and antennas, on about 1865 or so by a group of 7s.

And Wayne—Newfoundland was not an independent country in 1959. The province joined the Confederation on March 31, 1949.

Bob Eldridge VE7BS
Pemberton BC

191 Hz or 1 Meg?

I have to take issue with Mr. Hotine's claim that a narrow frequency spectrum is occupied by his method of phase modulation in which short pulses are used to phase modulate a carrier using a small deviation. The phase modulated signal can be expressed as:

$s(t) = A(\cos[wt + m(t)])$

where A is the amplitude of the signal, w is the carrier frequency in radians/sec., and $m(t)$ is the time-varying modulating signal.

Using a trigonometric identity, the equation can be written:

$s(t) = A(\cos[wt]\cos[m(t)] - \sin[wt]\sin[m(t)])$.

If the amplitude of $m(t)$ is small (less than 0.1 radians), the equation can be approximated:

$s(t) \approx A(\cos(wt) - m(t)\sin[m(t)])$

since $\sin[m(t)] \approx m(t)$ and $\cos[m(t)] \approx 1$ if $m(t)$ is small.

The equation shows a carrier component, $\cos(wt)$, and a double sideband component, $m(t)\sin[m(t)]$.

This second term determines the bandwidth of the signal. The modulating signal $m(t)$ is the superposition of the narrow pulse trains shown in Mr. Hotine's article (Fig. 1B and 1D), with one of the waveforms inverted, since one causes a leading phase angle and the other a lagging phase angle.

The bandwidth of a pulse train such as this is well known and will in fact be inversely proportional to the pulse width, $1\ \mu sec$ in this case. Therefore, the bandwidth of one sideband will be approximately 1 MHz, far greater than the 191 Hz that Mr. Hotine calculated.

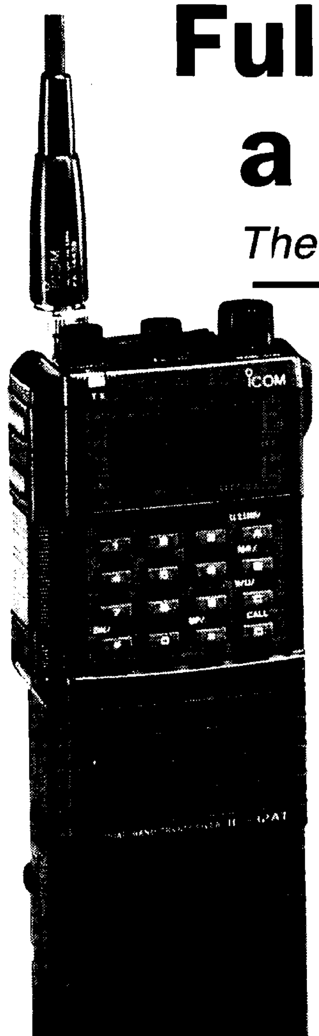
Dan Mulally WI●C
Rapid City SD

73 Review *by Jozef Hand-Boniakowski, WB2MIC*

Full Duplex in a Hand-held

The ICOM 32AT Dual-Band HT

ICOM America, Inc.
2380 116th Ave., N.E.
Bellevue, WA 98004
206-454-7619
Price $629



The 32AT, ICOMS's entry into the dual-band HT field, is a little beauty about the size of the 02AT. It is one of the slickest FM phone radios of any type that I have had the pleasure to use, and I've used many HTs and portable 2 meter ham gear over the years, beginning in 1967 with the Varitronics HT2.

Less rounded in appearance than the 02AT, the 32AT weighs 590 grams with the stock BP-70 battery, 510 grams with the BP-3, and 545 grams with the BP-4. The BP-4 pack is just a shell for two AA-size NiCds. With the BP-70, overall metric dimensions are 65mm x 180.5mm x 35mm.

Feature Packed

It takes a bit of reading to become familiar with the 32AT's features. Relying heavily on surface-mount technology, this dynamo sports 20 independent memories. Similar to the 02AT, you can program each memory with its own input and output frequency, PL tone, offset, and any frequency scan lockout. Each memory therefore has two stages. When not used, they serve as additional memory channels. If you programmed only simplex frequencies into memory, 40 channels would be available. In addition to the stock memories, there are two VFOs, one each for VHF and UHF, a priority frequency and two call frequencies, which again are one VHF and one UHF.

You can program quick frequency and memory selection through the keyboard or the main tuning dial, a welcome addition. For me, this was more memory, power, and flexibility than I could possibly use. The right hand column of the touch-tone pad has the A, B, C, and D keys. Used in conjunction with the function key located on the left side of the radio, they perform Clear-Scan-Stop/Transfer memory frequency into VFO, Memory Read/Write, and VHF/UHF Split operation and Call functions.

Full-Duplex Operation

The most amazing feature of the above is the Split function. It allows a memory to retain a TX frequency in VHF, and an RX frequency in UHF and vice-versa, AND allows full-duplex operation. That is, you can wear a headset and talk one on band while listening on the other, simultaneously—just like using a telephone! This is a great feature for public service communications, such as directing traffic, coordinating hamfest activities and bike-a-thons, and, of course, checking repeater links. Imagine full-duplex in an HT! The possibilities are astounding, including dual-band, full-duplex packet operation, and digipeating!

A word of caution: When operating full-duplex, your frequency on UHF receive must not be the third multiple of the VHF TX frequency. The third harmonic would be picked up, and you'd receive howling feedback.

Also, you cannot use the optional HS-10 headset. However, I can't see why a headset cannot be rewired or home-brewed for separate TX and RX audio lines. OK, ICOM, when will that accessory be available?

Scanning Capabilities

The 32AT comes equipped with scanning capabilities. You can set it to do a full band scan, a programmed band scan with user-defined top and bottom limits, a memory scan of both bands, or a selected band memory scan and priority watch. You can do the full band scan within one band only. In the memory scan mode, use the SKIP function to eliminate any memory frequency from being checked. SKIP functions with all of the 20 memory channels. It comes in handy when you need to put non-amateur frequencies into memory for occasional recall.

For example, I programmed 162.550 and 162.450 MHz into my 32AT for listening to NOAA weather information from Albany, New York, and Burlington, Vermont, with the SKIP function enabled for both frequencies. When I want to scan the 2 meter band, these are skipped over, thus preventing NOAA's 24-hour transmission from locking up the radio.

You can set the 32AT to temporarily stop for a few seconds on every active frequency, then continue. This allows a quick listen to busy repeater frequencies, and comes in handy when you're listening for a friend and you're uncertain about which repeater he or she will show up on.

Programming the 32AT

You can activate many combinations of scan and watch operations: VFO and memory channels, VFO and call channel, VFO and another band, and of course, all of the above with the priority channel.

With such complexity, you may be overwhelmed by the programming requirements. However, there is a SET mode, accessed by depressing the FUNCTION button along with the "5" key, which makes programming convenient. Then you can use the main tuning knob to set subaudible tone frequencies, offset frequencies, tuning steps (the rate of frequency change when using the main tuning knob or the UP and DOWN keys), scan edges, and whether you want the power saver on or off.

Continued on page 70

TECH TALK from ICOM

ICOM

Limelight Views of the IC-781

ICOM's incomparable IC-781 HF transceiver is truly creating widespread excitement in the amateur radio world and requests for additional plain language details continue filling the ICOM company mailbag. Thank you! Responding to your inquiries, this Tech Talk will overview some of the IC-781's most noticeable front panel operating attractions. Future Tech Talks will delve further into special features and circuit designs of this pacesetting transceiver.

So what's behind all the initial view "oohs and ahhs" of the IC-781? In addition to its numerous front panel controls and its five-inch multi-function CRT is a complete station control and monitor center with tremendous flexibility. Despite its sophisticated and futuristic appearance, however, the IC-781 is surprisingly easy to operate. Its special features are simply "called into use" as you desire.

The CRT's top section always displays your present operating frequency (in bold numbers) plus the selected mode, filters, RIT/XIT offset and VFO or memory operation. The alternate VFO's data is displayed below that bold/in use information. Although not readily apparent in ad photos, VFO A and VFO B plus any selected memory can also be set to different bands! A highlighted block in the CRT's lower right area also indicates local or world time right on the screen!

An impressively advanced concept of frequency selection and control is included in the IC-781. Initially pressing VFO A and rotating the main tuning knob selects frequencies in the usual way. Rotating that knob after pressing VFO B, however, lets you select standby operating frequencies on the alternate VFO while continuing an on-the-air QSO with the operating VFO! You can also change band and/or modes on VFO B or load informaton into any memory without disrupting an ongoing QSO! In other words, the VFO A and B buttons electronically shift only the main tuning applications. Totally unique! There's more! Press the CHANGE button and operating/standby VFO content swap positions. You can shift between VFO's and bands for rapid-fire DX'ing in a genuine contest-winning manner.

When split-frequency DX'ing, alternately working two DX pile-ups or lining up sequential contest QSO's, both VFO's contents can be received simultaneously. This dual receive function is activated by pressing the DUAL WATCH button then adjusting the front panel's BALANCE control for a comfortable VFO A/B blend. A single speaker is used for this simultaneous dual reception, and the previously mentioned VFO A or VFO B buttons select which VFO is tuned via the main knob. Simultaneous dual receive within the same mode on different bands like VFO A on 20 meters and VFO B on 15 meters is also a snap; however, greatest sensitivity always coincides with the operating VFO/bold numbered CRT display.

The panoramic display indicates all received signals within a horizontally-marked range of 50, 100 or 200kHz as selected by "F" keys in the CRT's escutcheon. The IC-781's present operating frequency always appears in the spectrum display's center with lower frequencies to the left and higher frequencies to the right of that point Horizontal marks indicate relative signal strengths, and background noise appears as "grass" along the bottom edge. It also reads your instantaneous signal level during transmissions.

On-the-air activities and DX pile-ups are easily detectable at a glance, and they shift position according to frequency selections on the main tuning knob. Visualize combining this superb asset with the DUAL WATCH and you, too, will echo the slogan **"ONLY WITH AN ICOM!"**

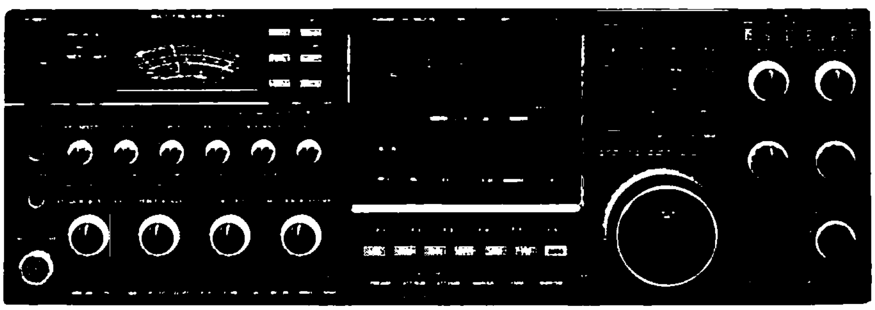
Pressing the CRT estutcheon's "F6" key changes its screen's lower area to indicate memory contents. Consequently, pressing the "F1" key and rotating the main tuning knob scrolls Memory 1 through 99 for reviewing their contents. Additionally, pressing the VFO/MEMO button switches frequency control from VFO to the cursor-indicated memory.

An electronic notepad for memory use can also be called up for use by pressing the "F5" button. Personal memos can thus be included in selected memories by selecting letters via the main knob with one hand while pressing the "F2" (Write) button with the other hand.

The previous functions, incidentally, can even be performed while you are in QSO or not selecting frequencies with the main knob. Visualize the versatility and convenience of this feature for noting schedules or net operations: you enter all details in memory and even program the IC-781 to switch on and remind you of DX activities!

Another press of the "F6" key changes the CRTs lower screen area into video display of printed modes like RTTY or PACKET. An external TU's RS-232 video data is connected to the IC-781's rear input "F" keys select compatible operating parameters, and you enjoy ultra-deluxe video readouts on the IC-781's screen!

The IC-781's innovative features and designs truly reflect ICOM's dedication to excellence: a proud tradition that is built into every ICOM unit Tune in with ICOM and join the winning team!



ICOM'S NEW IC-781 ***"The future of amateur communications."***

CIRCLE 84 ON READER SERVICE CARD

ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004 **Customer Service Hotline (206) 454-7619**
3150 Premier Drive, Suite 126, Irving, TX 75063 / 1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349
ICOM CANADA, A Division of ICOM America, Inc., 3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4 Canada

ICOM continued from p. 68

Changes in offset frequency come in handy when you're using repeaters with non-standard splits. The standard offsets are 600 kHz on VHF, and 5 MHz on UHF. There are 38 different tone encoder frequencies.

Coverage

The general coverage of the 32AT (USA model), guaranteed by ICOM to meet the manufacturer's specifications, is 144–148 MHz and 440–450 MHz. Within these frequencies, the double conversion superheterodyne receiver boasts a sensitivity of less than 0.25 μV for 12 dB SINAD and a squelch threshold of less than 0.158 μV. The RX audio is greater than 400 mW at 10% distortion with an 8 ohm load. Compared to the 2AT and 02AT, the 32AT RX audio is more than adequate, and in fact, a big improvement. The IF frequencies are 30.875 MHz and 455 kHz. The operational range of the 32AT receiver is 138–174 MHz and 440–450 MHz. For the transmitter, it is 140–150 MHz and 440–450 MHz.

There are five versions of the 32AT. They are the USA, Italian, Spanish, Australian, Southeast Asian, and European versions. The main differences are in the frequency coverage, while minor differences involve tone burst operation. In non-USA versions, coverage includes 430–440 MHz. This leads me to suspect that, as with the 02AT, a minor component removal or change is all that is necessary to extend the range of the USA version. Within the guaranteed range, the transmitter puts out a clean signal with +/− 5 kHz deviation. This swing is derived from a variable reactance frequency modulator.

LCD Display

The function display is large and easily readable. The LCD is sidelit with 2 green LEDs from left and right. The light button is just below the PTT. Once depressed, it gives five seconds of illumination if the main tuning knob or keyboard is not touched.

The function display includes frequency readout, "TS" indicator in SET mode (more on this later), "M" in memory mode, "C" in CALL CHANNEL mode with the appropriate numbers 1–20, "DUP" or "−DUP" indicating appropriate frequency split, "SPT" on full-duplex operation, "PROG" during programmed scan operation, "PRIO" in priority watch mode, "T" for activated tone encoder, "SQL" with optional pocketbeep UT-40, "T SQL" with optional tone squelch without pocketbeep, "SKIP" for skip a frequency during memory scan, "TO" for setting the subaudible tone, "OW" while writing an offset frequency, and "L" when the keyboard is locked. Finally, there is a large S/RF bar graph meter.

Versatility

The UT-40 transforms the 32AT into a pager. If the transmitting station's PL tone is the same as the tone set on the 32AT, and if the pocketbeep function is enabled, beep tones are emitted for 30 seconds, and the "SQL" and "(((.)))" displays on the HT's large LCD screen begin to flash. Within 30 seconds, press the CLEAR key ("A" on the touch-tone pad), or the PTT will cause the 32AT to select the tone squelch function and audio from the transmitting station. It is checked for PL tone, and, if it matches, audio comes through the speaker.

There is, however, a MONITOR button located just above the PTT and FUNCTION buttons which will disable pocketbeep operation and automatically break the squelch for frequency spot checks. MONITOR also works during casual listening, when you do not wish to break the squelch with the squelch knob.

Features at the top include a BNC antenna connector, external RX/TX audio and PTT, a13.2 V DC jack, volume control, a tuning knob for the dual VFOs, ON/OFF and volume control, squelch, and HI/LOW power.

In a previous product review of the μ2AT, I complained about how easily the ON/OFF knob can be accidentally and unknowingly set to ON, killing the battery. On the 32AT, ICOM has placed the squelch control on the top far left of the radio with the ON/OFF switch in the middle, thus eliminating this possibility. The 32AT ON/OFF switch is also more secure with a positive click.

> *". . . this dynamo sports 20 independent memories."*

Battery and Accessory Compatibility

The 32AT comes with the BP-70 battery, which provides 5.5 watts output VHF, and 5.0 watts output UHF in high power. The low power setting is 1.0 watts output on both bands. The BP-70's capacity is 270 mAh at 13.2 volts. ICOM made the 32AT compatible with all the 2A/AT and 02AT batteries and accessories. As a result, ICOM has not yet made a single full-sized HT which suffers from obsolescence.

In anticipation of the 32AT's arrival, I had a fully charged Periphex BP-8S super-battery ready to go. The 32AT easily played a 12–15 hour day. The programmable power saver function helps out here. If there are no incoming signals, PTT, or keyboard entries for more than 30 seconds, the 32AT shuts down, and goes into listen mode briefly every few seconds. This feature saves 10 mA on VHF and 12 mA on UHF.

ICOM battery pack life chart, based on a ratio of 1:1:8 of transmit/receive/standby operation:

Pack	Volts	mA	VHF Op hours	UHF Op hours
BP-2	7.2	450	3.7	3.1
BP-3	8.4	270	1.9	1.6
BP-5	10.8	450	3.2	2.4
BP-7	13.2	450	3.4	2.4
BP-8	8.4	800	5.8	4.8
BP-70	13.2	270	2.0	1.5

Also included with the 32AT are a good quality dual-band rubber ducky antenna, a belt clip with mounting screws and washers, an earphone, rain-proof cap, hand strap with clip, and a BC-16U wall charger. Popular accessories are available, such as an external speaker/microphone, headset (PTT or VOX), desktop battery charger, and a nifty little device called the UT-40 tone squelch decoder and "pocketbeep."

ICOM makes a rounded speaker/microphone that is very convenient to use with the 2A/AT/02AT radios. They are now also making a much smaller, sleeker speaker/mike called the SM46L. However, it has a right angle double connector, a miniature plug for the RX audio and a subminiature for the TX AUDIO/PTT, that bends right over the 13.8 V DC jack at the top of the 02AT/32AT. This makes external 12 VDC mobile operation very inconvenient. If the right angle were shifted 180 degrees, 02AT owners would be happy, but 32AT owners would find the cable jammed into the antenna.

The Culmination of High Tech

I bought my ICOM 32AT from Ham Radio Outlet in California in early June, and received it in late July. I knew that I was buying a new radio which might be included in the "test market" category, but I did not want to wait.

Being very active on packet, I quickly sent an "ALL" message inquiring about the 32AT. Surprisingly, I received a reply from an old friend in New Jersey who had purchased one as well. Steve WA2NHZ mentioned that he and a few others were having PLL problems. When running the transmitter for three to seven minutes in full duplex, they reported that the synthesizer would go out of lock in UHF. I tried to create the problem, but could not. Steve's 32AT had a lower serial number than mine. The serial number of my unit is 01267.

I can find no operational problems with the radio. In fact, I find the 32AT remarkable. I am thoroughly satisfied with its operation, and I have used it daily in my summer employment as a painter. The backplate/heatsink of the HT does not heat up as the 02AT's did. The 32AT is ruggedly constructed, and its sections and backplate are sealed with water-resistant gaskets.

My one and only complaint is minor—I am disappointed with the lighting on the LCD function display. If ICOM could have provided the back lighting of the μ2AT for the 32AT, this review would have been flawless.

We've come a long way in twenty years, since the Varitronics HT2. The 32AT is the present culmination of high tech. With ICOM and the IC-781 HF radio making such a splash with its built-in video display screen, I wonder how long it will be before we see a packet TNC and LCD text screen inside HTs? How long before a triband HT becomes available? The prospects of a full-duplex OSCAR HT are becoming more real. In the meantime, I'm having a lot of fun with a very nice radio.

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon, OH 44646

To maximize the use of solar energy, we need some means of storing it for use during cloudy days. Recall in physics the law of the conservation of energy: You cannot create or destroy energy, only change it. In this case, kinetic solar energy converts to potential energy, to be stored and later converted back to kinetic energy at will. The best container of this energy in its potential form is the lead-acid battery.

Good ol' Pb and H_2SO_4

Even in today's technology, the composition of a lead-acid battery remains basically the same: lead and acid. A lead-acid battery is typically constructed of lead or lead-alloy plates immersed in a sulfuric acid/water solution. This solution is called the *electrolyte*. Lead-acid batteries store and release electricity by a process know as an *electrochemical reaction*, which involves a series of chemical changes within the battery and the flow of electrons.

What happens when we discharge a lead-acid battery? When a battery is connected to an external load (e.g. a rig), current flows through the load and the battery starts to discharge. The lead dioxide, PbO_2, in the positive plate is a compound of lead, Pb, (sometime called "sponge lead") and oxygen, O_2. Sulfuric acid, the electrolyte, is a compound of hydrogen, H_2, and the sulfate radical, SO_2. As the battery discharges, lead combines with the sulfate, SO_4, found in the electrolyte, forming lead sulfate, $PbSO_4$, on the positive plate. Oxygen, O, in the active material of the positive plate combines with the hydrogen, H_2, from the sulfuric acid to form water, H_2O, which reduces the concentration of acid in the electrolyte. A similar reaction is occurring at the negative plate at the same time. Lead, Pb, of the negative active material combines with sulfate, SO_4, from the sulfuric acid to form lead sulfate, $PbSO_4$, on the negative plate. As the load remains (e.g, as we continue the use the rig), the discharging progresses, the newly formed water continues to dilute the sulfuric acid in the electrolyte, lowering its specific gravity. (You can measure the specific gravity with a hydrometer to accurately and conveniently determine the battery state-of-charge.) The active material of both plates slowly changes to lead sulfate, $PbSO_4$. The plates become more alike and the acid becomes weaker. Therefore, the terminal voltage lowers, since this is a function of the difference between the two plate materials and the concentration of the electrolyte. Keep using the rig, and you eventually reach a point when the battery can no longer deliver electricity at a useful voltage.

About Face

Using electricity from the photovoltaic array, we start the charge cycle. When we apply current to the battery, we simply get the reverse of the above reaction. This causes the specific gravity of the battery to raise as acid forms, replacing the water in the electrolyte.

A battery gives off gas as it charges; hydrogen from the negative plate, and oxygen from the positive plate. These gases result from the decomposition of water, H_2O. Heavy gassing can be caused by several conditions: overcharging, cold electrolyte, and old age. Since these gasses can combine violently, causing an explosion, make sure to properly vent your batteries. If your batteries are contained in an enclosure, make sure there's plenty of convective air movements such that air moves from the bottom of the containment to the top, then out.

Batteries are rated on the basis of capacity (in ampere hour, Ah, capacity) and life cycle (the number of times a battery can be discharged before failing). Capacity is directly related to discharge rate. For example, a battery rated at 100 amperes over 20 hours can deliver 5 amperes for 20 hours. The same battery will only deliver 70 amperes, however, if it is discharged within five hours. The faster you discharge the battery, the less capacity you'll receive. Battery capacity is also a function of size, construction, temperature, and concentration of electrolytes and plate construction.

Temperature has a direct effect on the capacity of a battery; the lower the temperature, the lower the amount of capacity available for use. A battery rated at 100% available capacity at 80°F is rated at 105% at 85°F. The same battery is rated at 90% efficient at 60°F. Long periods of higher-than-normal temperatures, however, decrease battery life. Warm temperatures will also cause the battery to overcharge. The opposite happens in colder months.

Battery cycle life depends on the depth of discharge. An 80% discharge (to a 20% state-of-charge) is considered deep. Best battery cycle life occurs at discharge depths of 60–70% of total capacity.

There are of course other factors that affect battery performance. Charging procedure is one. For example, if a battery is never allowed to be charged over its float voltage, two problems can occur. First, the electrolyte may stratify. The acid, being heavier than water, concentrates on the bottom, resulting in poor performance and increased susceptibility to freezing. Second, in a battery bank that has several batteries connected in series, one or more batteries may lose its capacity before the rest. This reduces the entire battery bank performance.

"Battery capacity is directly related to the rate of discharge."

Car Vs. Deep-Cycle Batteries

Let's look at deep-cycle vs. starter batteries. A deep-cycle battery supplies a relatively low amount of current for a long duration. Car batteries can supply a great deal of current for short periods, and run down and recharge repeatedly with a minimum loss of capacity. "If you want to run something, you select a deep-cycle battery; if you want to start something, get a car battery."

Now for a harder look at deep-cycle batteries. Deep-cycle lead-acid batteries are constructed with several different types of plate and grid compositions, depending on use. The pure lead battery typically has a very long life, 25 years or more. This is the most common type used by the phone company today to provide back-up power.

The second type of deep-cycle battery is the lead antimony. Lead antimony batteries have 2.5–4% antimony on their positive plates. They are the most common type of deep-cycle battery on the market. These batteries are designed to tolerate a deep discharge and have very good charge/discharge cycling capabilities. The antimony is, however, a real poison to the batteries. The lead antimony battery often requires an overvoltage charge during the charge cycle to assure that all of the batteries in the bank recharge to the same level. This is called equalizing the batteries. The lead antimony battery has a much higher self-discharge rate. As the battery ages, the self-discharge rate increases. The battery will also produce more gassing than others. Even with all this going against the lead-antimony battery, it's a solid performer!

The lead-calcium battery, as the name implies, contains lead alloyed with calcium. The lead-calcium batteries, which have about the same output and Ah rating as the lead-antimony batteries, usually do not require an equalizing charge, and they are less prone to self-discharge, typically less than 1 to 4% per month at room temperatures. They also produce less gassing when charged.

They have several disadvantages, however. Principally, they are limited in the number of deep discharges. Further, lead-calcium batteries are "maintenance free" batteries and are most often sealed. This stops you from taking the preferred specific gravity readings with a hydrometer. Finally, they are expensive.

The jury is still out on which type to use in a stand-alone PV system. I opt for the lead-antimony units. For ease of maintenance, others prefer the lead-calcium batteries.

Look to next month's column for a continuing discussion of batteries.

Before I Go...

I'm on the lookout for more mods for the for the Heath HW series of radios: the HW-7, HW-8, and the new HW-9. I'll be reprinting the HW-8 Handbook sometime in early 1989. In closing, when you turn it on, turn it down!

Number 24 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael Jay Geier KB1UM
7 Simpson Court
So. Burlington, VT 05403

Welcome to "Ask Kaboom." This column will dispense advice regarding the adjustment and repair of your rigs, with emphasis on modern solid-state gear. Many problems can be fixed right in your shack, saving you time and money, and fulfilling a basic purpose of amateur radio: the maintenance and advancement of technical skills. Besides, doesn't it feel great to use the old noodle instead of the old wallet?

Have you ever noticed when listening to a SSB QSO on HF that no two stations seem to be on the same frequency? They always appear to be 30 or 40 Hz offset from each other. It's especially frustrating in roundtable situations; you have to twiddle your RIT constantly. In the analog days, that was understandable, because VFOs weren't all that stable, and dials were neither accurate nor precise. In addition, many rigs had internal controls to set the transmitter and receiver to the same frequency, and these settings drifted over time.

With today's frequency-synthesized rigs, there is just no excuse for being more than a few Hz off frequency at any time. Yet, many stations continue to have this problem, due to a simple lack of calibration. In my experience, Japanese gear is often badly aligned at the factory! The problem is compounded by the fact that the crystals, which serve as the reference for the frequency synthesizer, drift, both with aging and temperature. So you can't assume that, just because you have a digital-synthesized radio, it is dead on frequency.

Invariably, there is a trimmer capacitor in the master reference oscillator which you can set to correct the error. In some rigs, like the Kenwood TS-940S, it can be accessed from the outside. In others, you will have to remove the covers to get at it. The big problem with this adjustment is that the manufacturers' instructions, if there are any at all, are so confusing that most folks can't tell when the rig is correctly adjusted.

Here is a simple method that will get you right on the money, with absolutely no test equipment. It is done best with a plastic tool (such as one found in Radio Shack's TV tool set, catalog number 64-2220, which sells for $2.99), but can even be done with a small screwdriver, as long as it has a plastic handle.

First, let the radio warm up for a good half-hour. While the rig cooks, get the owner's manual and find out where the master reference adjustment is. If there's no mention in the book, then look at the schematic and try to find it. Failing that, call up a ham store or the manufacturer and ask. The phone call is a lot cheaper than the shipping charges.

If you have to remove the covers, do so now, after disconnecting power and antenna from the rig. Find the adjustment and then reconnect the power and antenna and let the rig warm up for a few more minutes. Now comes the secret: tune in WWV on 5, 10, or 15 MHz. If 20 meters is open, 15 MHz is probably your best bet, but any of them will do. If you have 10 Hz readout on your display, be sure the last two digits are set to "00." If you only have 100 Hz readout, then you can't know precisely where you are, and can make things worse by adjusting the frequency to "15.000.00" when the rig is really set to "15.000.07." There is, however, an easy way out of this mess. The mikes that come with nearly all digital rigs have "up" and "down" buttons. Set the rig to "14.999.9" and then click the "up" button repeatedly until the display changes to "15.000.0." Now you are really set to "15.000.00" and ready to go.

You must wait until WWV is sending tones, rather than clicks. Place the rig in USB and listen to the tone. Now switch to LSB. If the pitch of the tone stays exactly the same, then your rig is dead on frequency. If it changes, then you must adjust your trimmer. If you are really tone-deaf, get someone else to listen for you. (A note to ICOM owners: Many of their rigs shift the frequency display when you change from USB to LSB. It is tedious, but you will have to go through the whole mike clicking thing to reset the display every time you switch modes.)

Slowly turn the trimmer just a little bit. Now, switch modes again. If the difference in pitch gets worse, then you turned it the wrong way. Go the other way and try again. Keep adjusting (slowly!) and changing modes until the tones are exactly the same pitch. Your rig is now precisely on frequency.

If you are using a metallic tool, you may find that the frequency shifts a little when you remove the tool from the trimmer. In that case, pull the tool away before checking the tones. This makes things harder, but the results will be the same. Be careful not to short anything with the metal in the tool!

When you're satisfied with the adjustment, shut off the rig, disconnect the power and antenna and close it all up. Voila!—no more complaints of "you're too high, OM."

As the radio ages, it may shift frequency slightly, you should do this procedure again if you are as picky as I am. I touch up my '940 about every six months.

Oh yeah, one caveat, there are other crystal oscillators (besides the master one we have just adjusted) and they, too, can drift off. If the rig seems REALLY far off, and one sideband sounds MUCH more muffled than the other, your radio may need more alignment than this, and probably should be seen by the service shop.

Now that we're all on frequency, let's look at some letters.

Dear Kaboom,

I wired up a favorite mike for my Kenwood TS-440. It works, but I get terrible RF feedback. This doesn't happen when I use the stock mike. What gives?

Signed,
Whattd I do

Dear Whattd I do,

When wiring the mike, you may have noticed that there were two grounds on the connector. Yes, they both go to the radio's ground, but there is an important difference between them. Pin 7, the "mike gnd," goes directly to the mike preamp circuit, and is the internal cable's shield. Pin 8, the "stby (standby) gnd," is the rig's general ground. It is done this way to avoid RF ground loops, which can cause the feedback problem you have. The shield on the mike cable should go to pin 7 and the PTT switch's ground to pin 8. Even if you have wired them separately, you may find that they are connected inside the mike! Open it up and separate them.

Dear Kaboom,

I use a 20-amp DC supply with an ICOM IC-28A mobile rig for a base station. Sometimes, there's a hum on my transmitted signal and other times, it's not there. Tests of the supply show no ripple at the output. Where the heck is that hum coming from?

Signed,
Hummin' Away

Dear Hummin' Away,

Sounds like RF is getting into the DC leads coming out of the supply. Check your antenna SWR and also make sure your antenna is not real close to the rig or supply. Never plop a mobile antenna on top of the supply. The RF is high enough in frequency to get past the filter caps and into the regulator, where it can mix with AC hum in mysterious ways and cause trouble. Try putting a .01 µF cap across the DC lines right at the supply. Also, keep the DC cord short, or try coiling it or wrapping it through a large toroid. Finally, try the same toroid trick for the AC cord.

Dear Kaboom,

My Yaesu FT-757GX has been in for repair twice now. Each time, the FM quit and then the whole rig wouldn't TX or RX. Now, it's doing it again. What should I do?

Signed,
Love it but Hate it

Dear Love it but Hate it,

This is a common problem in '757s which were made two to three years ago. The cause is bad switching diodes. The radio uses lots of diodes, rather than a relay, to switch between TX and RX. It's a good idea, but there was a run of bad diodes a few years back. They get leaky and allow voltage to the wrong circuits at the wrong times, causing the radio to try to TX and RX at the same time! The result is a blown transistor in the FM squelch circuit and a dead-acting rig. Sometimes, some tiny coils also get blown. This is a compact rig and not easy to work on. Also, they are special low-noise diodes and should be replaced with the same type. Unless you're really skilled, you're better off sending this one to Yaesu.

Finis

That's it for this month. Next month's topic: Troubleshooting, the art of finding what does work, not what doesn't!

Number 25 on your Feedback card

ABOVE AND BEYOND

VHF and UHF Operation

Pete Putman KT2B
3353 Fieldstone Drive
Doylestown, PA 18901

NY and Ontario Grid-peditioning

I don't know how these things get started. . . Sometimes you get an inspiration, sometimes just a cockeyed notion. Like trying to combine a long weekend with some grid-hopping. Like driving almost 1000 miles in 4 days via the "scenic route" for the privilege of standing in a downpour with 60 pounds of equipment on your back. Or running back and forth through Canadian and US Customs via inconvenient ferry trips to work a couple of stations on 903 MHz.

This was to be nothing more than a short jaunt up through New York state to the St. Lawrence River, where I'd board a ferryboat to Wolfe Island, Ontario. Once there, I'd spend a leisurely weekend helping my family close up their summer home for the season. . . get a little swimming and boating in. . . maybe a little fishing. . . maybe throw some 903 gear in the car and try operating from the back yard. . . no, make that the ferry slip at the southern end of the island. . . better take some 1296 gear along as well. . . maybe even something for 2304. . . not to mention a 2 meter liaison station.

Well, things got quickly out of hand (as usual) and I found myself speeding north on the Pennsylvania Turnpike on Thursday morning, August 25 with the Honda completely stuffed to the gills with camping and radio gear. Three loop yagis and 15 feet of antenna mast were fastened to the roof carrier, and I left behind more than a few very interested operators who would attempt to contact me in three different grids over the weekend.

I had decided to spend that evening at my aunt's house in Goose Bay, NY. . . just a few miles northeast of the dividing line between grids FN14 and FN24. Both are fairly quiet on the microwave bands, with most operation limited to grid-peditions. The plan was to drive to a suitable high spot after dinner and activate FN24 for a few hours on 903, 1296, and 2304, using 144.150 MHz as a coordinating frequency.

To that end, I packed the Yaesu FT-290R and a Microwave Modules MML-200S amplifier along with a Tonna nine element portable yagi to make sure I'd be heard. The Yaesu also served as the IF stage for the microwave equipment: An SSB LT-33S running barefoot with 20 watts on 903.100; SSB LT-23S and DownEast Microwave 2335PA running 30 watts on 1296.100, and a homebrew transmitter/receive converter running eight watts concocted by Ron Whitsel WA3AXV. The antennas were half-sized loopers designed by Bill Olson W3HQT, with 19 elements on 903, and 25 elements on 1296. Only the 2304 looper was full-sized at 45 elements.

The forecast called for clear skies and no precipitation through the weekend, so (of course) a good-sized thunderstorm showed up about 6 PM Thursday and washed out my carefully-laid plans. A quick call to Dave Hackford N3CX allowed me to re-schedule for early Friday morning, and I spent the better part of the evening assembling the stacking frame for the yagis as well as packing the car.

Station Setup

After dragging myself out of bed at 5 AM, the three stations were wired up on the passenger seat. A terminal strip was plugged into the main battery connector and I brought out 13.8 VDC lines to the two transverters and the amplifier. The Yaesu was fitted with the YBA-8 battery case, allowing a maximum of three watts output—suitable to drive the transverters or the MML amplifier to 150 watts output. An interconnected sequencing box made sure all the relays fired at the right time. The only trouble was keying it with a footswitch held in my hand!

The entire station managed to travel about 20 miles down Route 26 to the small village of Pamelia Four Corners, NY without crashing to the floor. . . quite an achievement in itself. After arriving at the chosen location—a 500+ foot rise along a lonely rural road—I set about erecting the mast sections and microwave antennas just in front of the Honda, using the bumpers as two of the guy anchors. This was made necessary by the soil adjacent to the road, which was very loose and sandy.

Despite all of the time I spent setting up the night before, things took longer than expected and I was unable to get a signal out on two meters until almost 7:15 AM. Considering it was a weekday morning and I was several hundred miles removed from my target audience, I didn't expect much activity on the liaison frequency. But lo and behold, there was Dave Halliday KD5RO in Pittstown, NY (near Rochester), all tuned up and ready to roll. Someone actually believed I'd make it on the air. . . will wonders never cease?

Dave's two meter signal wasn't too encouraging until he mentioned that his hardline was full of water. Seen in that light, his signal strength was amazing! We quickly QSYed to 903, working a path across Lake Ontario of about 100 miles with 599 reports either way. Dave suggested moving directly to 2304 MHz to take advantage of some nice tropo enhancement over the lake. It was a good call, as his 13 cm signals were just as strong as those on 903, hitting S-9 on peaks and never dropping below S-3. Our 1296 QSO was anti-climactic, as we both enjoyed armchair copy (well, bucket seat copy for me).

Wayne King N2WK was raised at work and got on the air a little after 9 AM, when we quickly exchanged reports on 903 and 1296. Were we having fun yet? You bet, so as you might expect a squall line quickly blew up over the lake and headed in my direction, with 40 mph wind gusts straining against the ⅛" diameter guy ropes. The 2304 attempt was brought to a sudden halt when the microwave array became airborne and landed ten feet away in the ditch. So much for FN24. SCORE: five contacts on three bands, four bent elements, and one ruined piece of coax.

North Of The Border

After fussing with the Canadian Customs and Immigration service and one wild ride across the St. Lawrence on the Kingston ferry, I

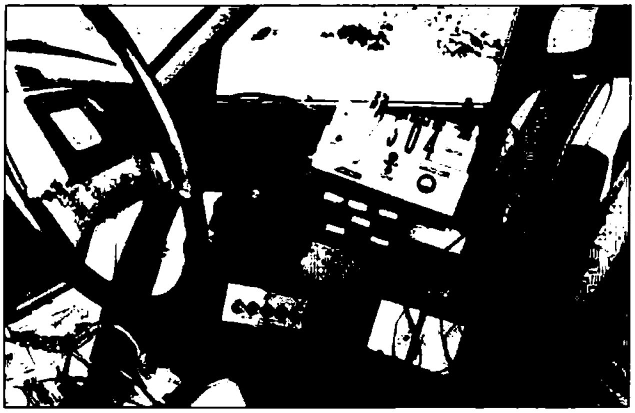


Photo A. The Honda Civic's front seat set up for 903, 1296, and 2304 MHz operation.

Photo B. The portable antenna array, with 19 elements on 903, 25 on 1296 and, 45 on 2304. Lots of gain in a small area.

arrived on Wolfe Island and immediately scouted out five potential locations for that evening. In keeping with the general trend, none proved suitable. It was the ferry slip or nothing!

The work at the house went fairly quickly, so I was able to spend some time repairing the loop yagis and reconfiguring all the equipment for Friday night. The two 12 volt gell cells needed to run the 2304 station were difficult to fasten down. The object was to keep the power run short, so everything wound up carefully stacked and balanced against the door and the seat. One sudden stop and CRASH!!! No more equipment!

Friday's blustery weather finally died down about 8 PM, so I bid adieu to the clan and drove for about 25 minutes to the Cape Vincent ferry slip. Unlike the Kingston ferry, this service stops after 7:30 PM and the area is relatively deserted at night (albeit well-lit). Three huge tires served as excellent guy anchors, and within a half-hour I was up and running again on 144.150 from FN14.

Contact was immediately made with K2SMN and K2OWR in New Jersey, and I was informed that quite a few stations were ready to take a shot on 903. Unfortunately, the excellent tropo conditions of Friday morning were nowhere to be found, which I assume was the price paid to Mother Nature for having such a beautifully calm and clear night! Both N3CX and K2SMN did report hearing my CQs on 903, although I was unable to detect anything coming back the other way.

Wayne N2WK was once again on with a potent signal, so we ran on 903 and 1296 with Tom Mott W2DRZ in Jamestown, NY tailending both times. Wayne's big thrill came when I finally heard his 2304 signal after about 15 minutes of back and forth CQs, giving him a new grid and me a headache from having the receiver volume up all the way! Shortly thereafter, KD5RO popped up and we quickly fired off QSOs on 903, 1296 and 2304. . . again, armchair copy each time. After a few more tries with K2SMN, I pulled the plug on FN14 at 1 AM. SCORE: ten contacts on four bands.

On The Last Leg(s)

All of the previous weather conditions did nothing to prepare me for the third and final leg of the trip up Cathead Mountain in the lower Adirondacks. I'd been up there during the August ARRL UHF Contest, operating 432 and 903 with splendid results, but this time things were going to be a bit rougher.

I proceeded serenely along to my tent site at Northampton Beach State Campground, assured by the ranger that no rain was in the immediate forecast. The backpack was loaded up and the antennas broken down for the climb next morning. The pack was quite a bit heavier than I had planned, tipping the scales at well over 50 pounds! This was largely due to the two gell cells which made up 16 pounds of the total weight. . . a necessary evil.

Six hours of driving and packing made nodding off easy at 10 PM. Thirty minutes later, I was jolted awake by a tremendous thunderstorm and torrential rains. It continued to rain off and on all night long, and a heavy fog had settled around the campsite as the alarm went off at 5:30 AM. It didn't look any better at the base of the trail an hour later. To scrub or not to scrub. . . that was the question. Well, the temperature was comfortable. . . I had plenty of bug repellent. . . everything was packed up as tight as possible. . . what the heck!

One of the quaint features of the Cathead trail is that it does double duty as a stream-bed after heavy rains. This and the extra ten pounds of stuff on my back combined to extend the climb to nearly one hour and 45 minutes, after which I reached the top of the mountain and was promptly soaked in a downpour. To make things worse, there are no sheltered areas on the mountain to operate from, so my choices were simple: (1) Give up and retreat or (2) Wait it out at the ranger cabin 100 feet down from the top.

Option two gave me a chance to dry out (slightly) while looking for a glimmer of sunshine. After 45 minutes without rain, the ranger solemnly informed me that the forecast called for thunderstorms the rest of the day. Weighing his advice carefully and considering my soaked condition, I made the only logical decision: Go back up to the top and get on the air from FN23!

This was the fastest I've ever set up on a mountaintop, with all four bands fully operational within 20 minutes. Although things got off nearly an hour late, the faithful listeners were quickly raised, and I banged out four 1296 contacts with WA2TEO, N3CX, K2JWE,

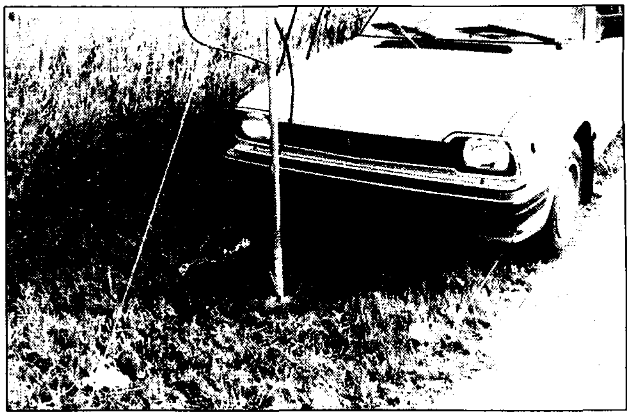


Photo C. Mast support plate and guy lines. The Honda makes a good anchor point!

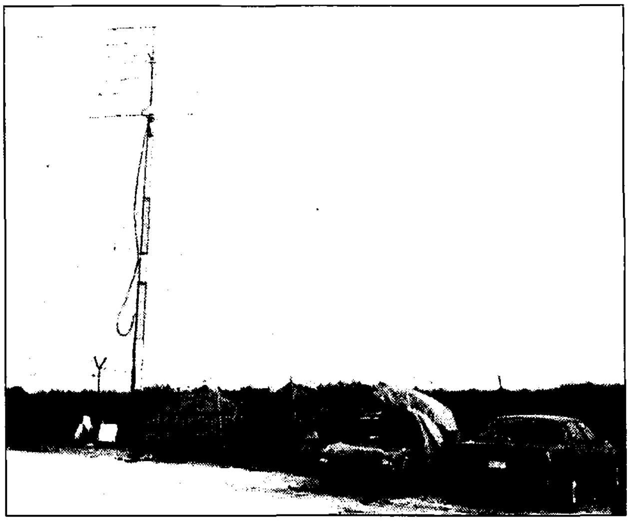


Photo D. Last year's modest setup will be replaced by three separate towers plus lots of aluminum!

and K2SMN. N2FRB and KA2CKV in FN30 were worked on two meters for their first FN23 contacts. A sked with W3IP in Baltimore didn't pan out (although I did hear his signals), so it was back to 1296 for a QSO with Bill K2OWR. N3CX ran with me on 2304 and copied a little bit of CW, but the on-and-off cloud cover wasn't making things any easier.

Finally, KD5RO showed up to try for the 13 cm hat trick. We quickly made contact on 1296 for another new grid but the path looked pretty bad, as copy was rough on both sides. No armchairs this time! To make matters worse, the batteries were running down, causing instability problems with the 903 station. And—you guessed it—thunder was now heard to the northwest. Despite the odds, Dave and I finally hooked up after about ten minutes, giving him three new grids on 2304 in three days! I signed off with K2SMN and crammed everything into the pack, making a quick getaway down the mountain about 1 PM. SCORE: nine contacts on three bands, two dead batteries, three banged up loop yagis, and a nice head cold.

The grand total for the weekend was 23 contacts. Not quite as many as I'd hoped for, but given the cards I had to play with, I'll take'em. The cold will go away soon, and I'll get over that sore shoulder eventually. The loopers can easily be repaired as can the nine element Tonna for two meters. All the sand I brought back in my shoes will end up in Ross' sandbox. Most importantly, the memories—good and bad—will last a long time. And maybe–just maybe—it'll be a little easier next time I go. . . Above and Beyond. 73

Dx

Hams Around the World

Chod Harris VP2ML
PO Box 4881
Santa Rosa, CA 95402

The 4J1FS M-V Island DXpedition

In early July, 1988, a team of three Finnish and three Soviet amateurs operated 4J1FS from the tiny island of Malyj Vystoskij, in the Bay of Vyborg. The one-mile-long island lies about 75 miles northwest of Leningrad, and only 25 miles from the border between Finland and the Soviet Union.

The unique DXpedition started as the Finns drove their van, heavily laden with a tower, antenna, rig, amplifier, generators, and lots of gear, down the roadway bordering the Saimaa Canal, surrounded by Soviet territory, to the last lock of the canal, on the Bay of Vyborg, at the eastern end of the Gulf of Finland. John Ahlbom OH5NZ, Pertti Turunen OH2RF, and Martti Laine OH2BH made up the Finnish half of the joint east-west DXpedition. Their gear totaled 800 pounds, and included tables and chairs, as well as drinking water, food, tents, and even a bag of toilet paper!

Off To The Island

On July 7, 1988, the three DXpeditioners loaded their gear onto the 50-foot motorboat *Veera*, for the short ride from the lock to Malyj Vystoskij. The boat stopped at a Soviet Coast Guard station to pick up the Soviet half of the joint DXpedition: Enn Lohk UR2AR, Boris Stepanov UW3AX, and Gene Shulgin UZ3AU. The bare-chested Finns (it does get hot in Finland in July!), showed their papers to the guards at the Coast Guard station, and then all six sailed the short distance across the bay to Malyj Vystoskij.

The crew quickly unloaded their gear and started to set up the tower, antenna, and gear. Their operating permission restricted them to a single rig, so they decided to concentrate on 20 meters. A 40-foot aluminum tower was capped with a KLM KT-34A. A Kenwood TS-940 and TL-922 provided the 4J1FS signal. They gassed and tested the 3 kW Honda generator, and all was ready for the opening gun, at local midnight.

Operating

The gang concentrated on SSB, and made about 70% of the total 14,800 QSOs on that mode. About 5,000 contacts were made with US amateurs, and another 5,000 with Europeans. They were even successful in working 2,500 Japanese DXers over the difficult polar path. Excellent propagation prevailed for the entire operation, to the great pleasure of the DXpeditioners.

They were allowed to operate only for 96 hours. Just before shutting down, UW3AX and UZ3AU carved a center insulator of scrap wood, and improvised a low-band antenna for a few contacts. On July 12, they lowered the tower and antenna, packed up their gear, and took the short boat ride back to their respective countries. The first-ever joint east-west pure DXpedition drew to a successful close.

> ***"The gang concentrated on SSB, and made about 70% of the total 14,800 QSOs on that mode."***

History of Malyj Vystoskij

Malyj Vystoskij lies near the mouth of the Saimaa Canal. The canal was first constructed in 1856 to provide access for ocean-going vessels to the lake region of southeastern Finland. During World War II, the Soviet Union annexed that portion of Finland, incorporating the canal and Vyborg Bay into the Soviet Union. In 1962, the Soviets agreed to lease back to Finland that part of the canal that ran through the now-Soviet territory. Malyj Vystoskij Island was part of that 50-year lease. The Finns intended to set up a reloading port and storage facilities on M-V Island, but the plans were never carried out. The civilian population of the island left in World War II, and the island has since remained uninhabited.

The Saimaa Canal, and M-V Island, are administrated by the Saimaa Canal Authority (SCA), which is composed of commissioners appointed by both Finland and the Soviet Union. To get permission to operate from the island, the DXpedition team had to secure not only the permission of the SCA to land on and operate amateur radio from the island, but also permission from the USSR to cross the intervening territory, which swarms with military activity. The complexities of getting all proper papers, and the need for discussions at the highest levels of government in both the USSR and Finland, prevented easy access to the island. In fact, the Finns worked on obtaining such permission for about 20 years!

In the 1960s, Finnish amateurs felt that the island would qualify as a new DXCC "country" under the "separation by foreign land" provision in the DXCC country criteria. The island is essentially surrounded by Soviet territory, and thus met Point 3 of the DXCC country criteria in 1970.

The ARRL Awards Committee agreed with the Finns, and then-DXCC administrator Bob White W1CW wrote a letter to the Finns saying that the island would be added to the DXCC list "at such time as operation takes place." There the matter sat for almost 18 years, until the 4J1FS DXpedition.

DXCC Questions

Will Malyj Vystoskij count as a *new one* for DXCC? The situation has raised many questions, questions that must be answered before the DXAC can make a decision.

The first question, and perhaps the most basic, is whether the island can be immediately added to the DXCC list on the basis of the 18-year-old letter from W1CW? The Finns feel that they have a firm commitment from the ARRL that Malyj Vystoskij would be added to the DXCC list "at such time as operation takes place" from the island. There are no conditions nor time limit imposed.

The ARRL however, elected to treat M-V island as a new application for separate country status, and referred the matter to the DX Advisory Committee for evaluation.

This raises two more questions: Should the application be evaluated under the DXCC guidelines that prevailed in 1970 or should the new DXCC rules, adopted by the ARRL Board in January, 1988, be used instead? If the latter, does Malyj Vystoskij count as one of two islands, or must the more stringent 75-mile separation limit be used? (M-V is only 25 miles from Finland, and would not count as a separate country under new Point 3(a).) So which rule applies, continent land mass—Point 3(a), or Islands—Point 3(b)?

The use of the 4J1FS callsign confused many DXers. If Malyj Vystoskij island is actually Finnish territory, why did the DXpeditioners use a Soviet 4J callsign? They argue that the SCA does not have its own International Telecommunications Union (ITU) callsign allocation, and thus any callsign can be used, as in the case of Spratly or Abu Ail. Discussions with the Russian Radio Sport Federation (RSF) led to the issuance of the 4J1FS call, symbolizing the first joint Finnish-Soviet DXpedition. The RSF only provided a distinctive callsign, not a license. SCA licensed the operation.

Further evidence that the island is indeed under Finnish and not Soviet jurisdiction is that the Finnish members of the team did not have Soviet visas, normally needed by Finnish visitors to Soviet territory. Their passes were issued by the SCA, not the USSR.

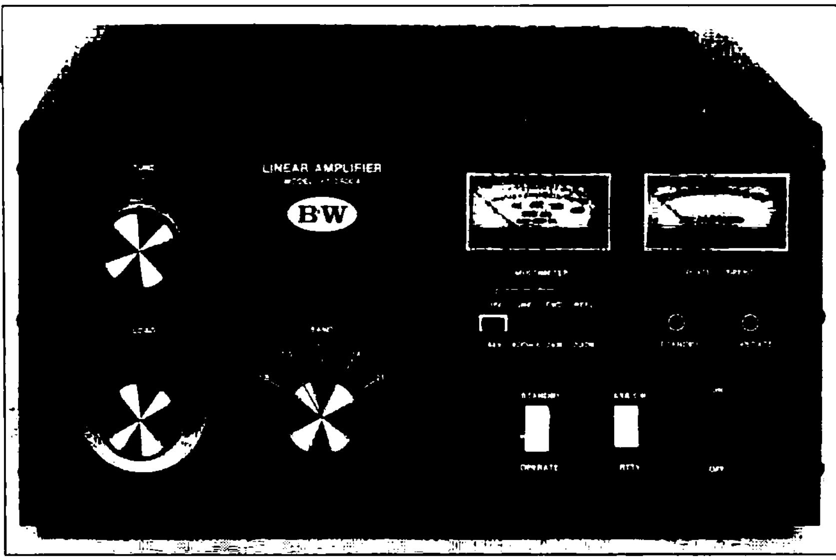
The DXAC has a great many questions to resolve over the DXCC status of Malyj Vystoskij, but regardless of their determination, the 4J1FS was a splendid example of east-west cooperation, persistence, and planning. Congratulations to all involved! ■

73 Review *by Larry L. Ledlow, Jr. NA5E*

Barker and Williamson PT-2500A HF Amplifier

Speak softly and carry a big signal

Barker and Williamson
Bristol PA 19007
(215) 788-5581
Price: $2175



Part 97 states that amateurs should use the minimum amount of power necessary to carry on a contact. Often it's 10 watts, sometimes 100. There are those times, however, when that extra few dB make all the difference, especially in contests and DX pileups. These situations demand both craft and a solid kilowatt. For the latter, Barker and Williamson has just the linear you need: the PT-2500A 1.5 kW amplifier.

Sensible, Mature Design

In one relatively small, 80-pound package, B&W has produced a superb Class AB2 linear amplifier rated for continuous duty at 1500 watts output. It will run happily and quietly for extended periods in SSB, AM, CW, ATV, and RTTY. The PT-2500A offers excellent performance for any mode or style of operation.

The PT-2500A uses two Eimac 3-500Z zero-bias triodes, real tried and true workhorses in many HF amp designs. In fact, the PT-2500A uses a sensible, mature design all around. As a Class AB linear amplifier, it produces very little intermodulation distortion, −33 dB according to the specifications. Typical plate efficiency for such an amplifier is 60–65 percent, and the PT-2500's manual guarantees a minimum of 60 percent on all HF bands. This amplifier requires a 100–125 watt drive for full output power. Most contemporary HF rigs can supply at least 100 watts of drive.

Circuit Superiority and Plenty of Power

Each band uses a separate pi-network for its input circuit. These are superior to L-networks, since they attenuate harmonics more effectively, and match somewhat greater impedance variations. Accurate matching on the input is essential, especially using a solid-state transceiver as a driver. Further, although two Eimac 3-500Zs in parallel operating at 3 kV (in a grounded-grid design) have an input impedance just over 55Ω, circuit Q must be maintained.

The output circuit is a pi-L design using a 235 pF, 6 kV variable tuning capacitor and a heavy-duty, silver plated 7 kV rotary inductor, which allows impedance matching over an even greater range than the simpler pi- and L-networks. Pi-L circuits attenuate harmonics better than the other networks, typically −50 to −55 dB with circuit Q in the 10–15 range. The PT-2500A specification calls for 50 dB minimum suppression of harmonics, easily meeting FCC requirements. (Part 97.73 specifies no spurious emission shall exceed −40 dB below the fundamental or 50 mW. Assuming a mean carrier power of 1500 watts, 50 mW is −44.8 dBc.)

Since the PT-2500A uses a grounded-grid (cathode-driven) design, it is well suited for HF linear operations. Actually, grounded-grid amplifiers require higher drive levels than, say, grid-driven circuits. Also, the design must precisely maintain circuit Q, or waveform distortion occurs. The Pi-L output circuit components assure constant Q, and so help minimize intermodulation products.

A chain is only as strong as its weakest link, and in many amplifiers, the power supply is given less attention than the rest of the circuit. Not so here. B&W has designed a power supply worthy of a continuous-duty amplifier. It uses a main transformer rated at 1300 VA, a separate filament transformer, as well as "computer grade" filter capacitors. Although B&W recommends 230 VAC primary power, the unit will run from 115 VAC if 25–30 ampere service is available.

Assembling the PT-2500A

When the UPS man finally delivers the three boxes comprising the PT-2500A main components, you won't spend the rest of the week fiddling with cables or soldering. Unpacking and component integration take an hour or two, depending on your familiarity with components. Proceed slowly and carefully, in any case.

The 3-500Z tubes, the main chassis, and the 40-pound power supply transformer are packed and shipped separately. Aside from the usual paperwork, you get two control cables, an AC power cord, two tube chimneys and plate cap heat sinks, three extra fuses, and a 7/16" T-wrench.

Transformer installation is the most tedious exercise, but requires only a screw driver and the T-wrench. After opening the main unit's cover, the power supply filter bank is removed (three screws). Then the transformer is carefully positioned over three ¼" threaded mounting studs that protrude upward from the chassis bottom. The T-wrench screws ¼" nuts to the studs, thereby securing the transformer in place. A wiring terminal block then attaches to the top of the transformer, and six transformer primary leads and plate harness leads are attached to the block. Several other leads and jumpers are connected before installing the power tubes.

Despite their power-handling ability, the 3-500Zs are still mechanically fragile. It's worth

the extra few minutes to carefully inspect each tube and chimney for possible damage. A magnifying glass can help highlight small cracks. (Report damage to the carrier.)

The tubes drop relatively easily into place. Do not twist the glass tube envelopes! They will break. Also, be careful not to bend or break the base pins. Even moderate lateral force can damage the tubes. Assuming the tubes are undamaged at this point, the glass chimneys mount concentrically around them. The plate heat sinks then screw atop the tubes, and the sinks in turn accept a screw connection from the parasitic chokes. Voila! An amplifier almost ready for action.

Don't even think about plugging in the AC power cord until the cover is secure again. The PT-2500A has microswitches closed by proper cover seating, and only then will main power be available. Good safety practice, however, insists on no AC connections until the cover is screwed back on. Remember, this is a high-voltage device, not a solid-state transceiver with CMOS circuitry and TTL voltage levels. Treat the amplifier with the utmost respect and with safety in mind.

After the RF input, connect the antenna relay (key down) and ALC cables between your transceiver and the amplifier, and attach a properly resonant antenna (SWR less than 2:1, and preferably less than 1.5:1) or a dummy load to the RF output connector. Use the latter while becoming familiar with control settings and tuning.

Dream Shack Operation

The controls and meters are surprisingly simple to understand, and the instruction manual clearly explains each function. Review the manual BEFORE turning the power on.

The large vernier knobs on the amp's left face control load and tune settings for adjusting the output impedance to the load, and tuning the variable RF capacitor, respectively. The scales are 0–100, which make accurate recording of settings very easy. The knobs' actions are very smooth, though with respectable resistance to prevent inadvertent movement. The six-position bandswitch—yes, it only has five markings—selects the band of operation: 160, 80, 40, 30, 20, 17, 15, and (with modification) 10 meters.

Two white rocker switches below the meters select SSB/CW/RTTY modes and OPERATE/STANDBY. The multi-function meters show plate voltage and grid current, as well as forward and reflected power.

The first moment of truth is always the initial flip of the main power switch, and I got quite a surprise when my PT-2500A came to life: It was quiet! I could actually carry on a whispering conversation without an obtrusive whirring from the 60 cfm squirrel cage fan. QRM on the band is bad enough, but hours into a contest I have found myself hating unnecessary noise in the shack. What a nice surprise, indeed, to find the PT-2500A MUCH quieter than the old Alpha 340 I had come to despise.

The second moment of truth comes with the application of RF to the input for initial tune-up. No problem here, and tune-up is very simple. Fortunately, the PT-2500A does not require a warm-up period. The green OPERATE lamp lights when the STANDBY switch is flipped to OPERATE. With no input, a quick check of the plate current should show 40 mA and 100 mA in RTTY and SSB modes, respectively. A quick adjustment of the exciter drive so the grid current is 90 mA (CW mode) followed by alternating TUNE and LOAD adjustments, will resonate the amplifier.

"The first moment of truth is always the initial flip of the main power switch, and I got quite a surprise when my PT-2500A came to life . . ."

After several more checks to make sure the currents and voltages are within specs, the PT-2500A is ready to speak to the world. For fumbling fingers or forgetful hams, the PT-2500A has an SCR grid protection circuit, which will shut the amplifier down if grid current exceeds 400 mA. This is a nice feature, particularly for hams who forget to reduce drive or who get carried away and try to get every last milliwatt out of their amp by overdriving it.

Several months of use didn't turn up anything wrong with the PT-2500A. It worked great in all modes. It does not key fast enough for AMTOR or QSK CW, but with a long TXDELAY, it's even fine for HF packet. All signal reports were clean; no one reported AC hum or other signal distortion. A sonagram taken by a friend several hundred miles away showed no leading edge clicking or chirp from 35 WPM CW signals. In a dozen comparisons of audio quality of SSB signals with and without amplification, there were no remarkable changes in signal characteristics except strength, indicative of little intermodulation distortion.

It's too bad I had to send the demo unit back. The PT-2500 fits in quite well with the "superstation" many of us dream about. Considering the bang for the buck (about $1.45 per watt), it's a pretty good deal. B&W is known for quality products, antennas, and components. The PT-2500A linear amplifier is worthy of their name. I know what's going on my Christmas wish list this year. . . ■

SPECIAL EVENTS

Ham Doings Around the World

ORLANDO FL
DEC 3

Shows Unlimited, Inc., is holding its annual PC Fest Computer Show and Sale. It will be held at the Orlando Twin Towers Hotel. The show consists of: supplies, chips and ICs, software/hardware, new and used equipment, local and national dealers, closeouts and liquidations, Commodore, Amiga, and Atari Software, brand names, IBM Clones, Apple products and savings of 25–85%. Show hours are from 10 AM to 4 PM. For more information to reserve a table or to get on the mailing list contact: *Shows Unlimited, Inc., at 301-970-2210 or 301-626-0311.*

FLAMINGO FL
DEC 3-4

The Everglades ARC will operate W4SVI from 1400Z Dec. 3 to 1900Z Dec. 4th, to celebrate the 41st anniversary of Everglades National Park. Operation on CW is near 7030, 14030, and 21130 kHz, and on SSB, near 7230, 14230, 21330, and 28375 kHz. Novice contacts on 7130, 21130, and 28375 kHz. Send QSL and 2 stamps for unfolded certificate. Novice certificate for those who identify as Novices on 2 of 3 bands, no stamps required. *E.A.R.C., PO Box 113, Homestead FL 33090-0113.*

SAN BENITO TX
DEC 3-4

The San Benito ARC's Texas State QSO Party is from 0001 UTC the 3rd to 2359 UTC the 4th. Texas stations may contact any station, non-Texas stations may contact only Texas stations. All amateur bands, except WARC. Three contacts of 1 each per band permitted. Suggested frequencies are 40 kHz up from band edge for CW, and 1.890, 3.885, 7.285, 14.285, 21.360, and 28.405. Novice segment CW operation, 25 kHz up from low band edge. Certificates. For information on exchanges, scoring, and certificates, contact *San Benito Amateur Radio Club: #2247 SSC, PO Box 1382, San Benito TX 78586-1382.*

APACHE JUNCTION AZ
DEC 3-4

The Superstition Amateur Radio Club will host the 1988 ARRL Superstition Hamfest at the corner of Brown and Meridian. Swap and shop both days. Test booth with 120 volts AC and antenna. Food, camping (no hookups). Tailgate admission is $3 and general admission is $1 for both days. Primary talk-in will be on 147.12(+) repeater, and on the 145.41(−)/223.82(−) link system. You can obtain information on 146.74, 146.94, and ZIA system repeaters as well. Contact *Bill Glaze KA7SUF at 602-832-3955 or Larry Kuck WB7CRK at 602-986-2298.*

HAZEL PARK MI
DEC 4

The Hazel Park Amateur Radio Club will hold its 23rd Annual Swap & Shop at the Hazel Park High School, 23400 Hughes. General admission is $2 in advance, $3 at the door. Children under 11 free. Tables, $1 per foot. Plenty of free parking. Talk-in from the 9-mile and I-75 area on 146.640−. For tickets and table reservations, contact *H.P.A.R.C., PO Box 368, Hazel Park MI 48030.*

JACKSONVILLE FL
DEC 4

Shows Unlimited, Inc., is holding its annual PC Fest Computer Show and Sale. It will be held at the Prime Osborn Convention Center. The show consists of: supplies, chips and ICs, software/hardware, new and used equipment, local and national dealers, closeouts and liquidations, Commodore, Amiga, and Atari Software, brand names, IBM Clones, Apple products and savings of 25–85%. Show hours are from 10 AM to 4 PM. For more information to reserve a table or to get on the mailing list contact; *Shows Unlimited, Inc., at 301-970-2210 or 301-626-0311.*

ALABASTER AL
DEC 10-16

The Shelby County Amateur Radio Club will operate AC200T to celebrate the 200th anniversary of the US Constitution and the opening of the club station in Pelham, Alabama. AC200T plans to operate all HF bands, concentrating on CW and SSB. Other modes will be used if available. Special efforts will be made to contact Novices. Include SASE with QSLs and send to *W4DYL, 632 Glen Park Drive, Fairfield AL 35064.*

NEW CARROLLTON MD
DEC 17

Shows Unlimited, Inc., is holding its annual PC Fest Computer Show and Sale. It will be held at the New Carrollton Howard Johnson's Hotel. The show consists of: supplies, chips and ICs, software/hardware, new and used equipment, local and national dealers, closeouts and liquidations, Commodore, Amiga, and Atari Software, brand names, IBM Clones, Apple products and savings of 25–85%. Show hours are from 10 AM to 4 PM. For more information to reserve a table or to get on the mailing list contact; *Shows Unlimited, Inc., at 301-970-2210 or 301-626-0311.*

BURLINGTON IA
DEC 17-23

The Iowa Radiosport Society will be operating Amateur Radio Special Event Station K20ORW in celebration of the Constitutional Bicentennial and the 150th anniversary of Burlington, Iowa, as the first territorial capitol. Operations will be on CW and SSB, as propagation permits, with special emphasis on operations in the 10 meter and other Novice segments. Special QSL cards will be available for return upon receipt of SASE or SAE and IRC sent to: *I.R.S.A.C., 923 N. 9th St., Burlington IA 52601.*

GARLAND TX
DEC 24-30

K200QHD, of the Garland Amateur Radio Club, will operate CW, SSB, and digital, on 80 through 10 meters beginning 0001Z the 24th through 2359Z the 30th. For special QSL, send your QSL and SASE to *KF5PE, 2934 Cotton Gum Road, Garland TX 75044.*

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus, CA 91350

The Save 220 NTRN

How does amateur radio tell a deaf-eared FCC that we will not accept their highly questionable reallocation of 220–222 MHz? This was the question puzzling *220 Notes* Editor Art Reis K9XI and myself when we sat on the phone trying to find some answers to this and other allied questions.

Since the release of the Report and Order on PR Docket 87-14 last August, the amateur community continued to grow ever more incensed at what it saw. In its decision, the Commission used arbitrary and capricious methods to take 220–222 MHz from hams and give it to private business interests. Even after the story dropped from the front pages of the various amateur news publications, the level of resentment toward the Commission, and specifically its Office of Engineering and Technology, continued to grow. That became a story unto itself. Usually, without follow-up coverage, nothing is forgotten sooner then yesterday's news. It wasn't the case here, as everyone—be it the Novices on 10 meters and the repeaters of 1¼ meters, the Techs of 2 meters, the DXers on 20, or the late-night Extras in QSO on 75—became involved and *stayed* involved. The inter-community and intra-community chatter was the same: *US hams will not rest until the reallocation decision is reversed and the entire spectrum from 220–225 MHz is declared "amateur exclusive!"*

> *". . . bungled divided efforts would only ensure that the FCC decision would stick."*

Fits and Starts

There's great motivation in the amateur community to fight this matter, but many people are going off half-cocked in their attempts. The worst it of all seemed to be the ham/lawyers, many of whom obviously did not understand either the terms of the Federal Administrative Procedures Act or the limits available to them in the Federal Court system. They were heard loud and clear before many clubs and on many nets with their threats of Civil Rights suits against the FCC. Fortunately, one perspicacious ham/lawyer, Joe Merdler N6AHU, pointed out the danger of all the rhetoric and posturing—bungled divided efforts would only ensure that the FCC decision would stick. Unity was desperately needed.

Resurrecting the NTRN

Enter the NTRN. Many people were involved in getting the National Teleconferencing Radio Network (NTRN) back up and going. (See November "Looking West" for details.) Lou Appel K/0IUO is the unsung engineering hero of these events. He supplied the mid-USA telephone intertie system and was the man who sat there controlling it during each of these events in the past, and came through for us in shining colors again on 2 October.

There were four basic jobs to do, and really only two people to do them. We worked out the NTRN format in one night. We needed a panel of experts representing every interest on 1¼ meters. We had to publicize the time and date of the NTRN. Finally, we had to register all participating outlets where the NTRN would be heard and assigned a port on the teleconference bridge.

While Art put together the "panel" and secured studio facilities, I alerted the vast majority of active hams in the US to the NTRN through my Westlink Radio Network Newsline, and other newsletters. Soon the phone at my house was ringing day and night with requests for teleconference bridge assignments. Only repeater groups, bulletin stations,

Continued on page 100

Number 29 on your Feedback card

QTH-DX

QTH is Christmas Island

Leon Fletcher N6HYK
274 Webster Drive
Ben Lomond, CA 95005

The Yuletide Island

On Christmas day in 1643, Captain William Mynors of the Dutch sailing ship *Royal Mary,* spotted a small isolated bit of land in the Indian Ocean and named it Christmas Island.

Apparently Captain Mynors was navigating from an outdated chart. The island had actually been discovered 28 years earlier, in 1615. Richard Rose, master of the *Thomas*, founded this island and named it Moni on a Dutch chart dated 1618.

Today, the name Christmas Island has won out, but the island is still largely unknown. Although the island is Australian territory, the information officers at both the Embassy of Australia, in Washington DC, and at the Australian Tourist Commission in California, said they'd not heard of the island. The latest *Current Report* about Christmas Island, sent out by the Australian Information Service, is five years old. In the last four years, the 400 "major magazines" published in the United States have printed only two articles about the island. In the giant *Australia Encyclopedia,* the island gets just a two and one half inch notice.

Out Of Obscurity

Such solitude will soon be gone if the Australian government's plans work out. They authorized the construction of a 170-room hotel-casino, scheduled to open by the end of 1989. Private investors are planning additional hotels, restaurants, charter fishing boats, and other leisure activities.

Such changes are needed on Christmas Island. The island has been relying on just one economic base—the mining of phosphate, a vital ingredient in fertilizers. The mining hit its peak in 1978, when more than 1.26 million tons of phosphate were exported. In December 1978, with the supply of phosphate nearly exhausted, mining stopped. But in July 1988, the Australian government announced that mining may resume.

Santa Claws

Still, other economic resources are clearly needed. In addition to tourists, the government is trying to entice small-scale manufacturing and agricultural ventures. But a bothersome block to those plans—actually inhibiting virtually all activities on Christmas Island—are the swarming red crabs.

Once a year in late spring, for about nine to 18 days, some 120 million of the crustaceans—nearly 9,000 tons—march on a breeding migration from the inland forest to the seashore. Their claws are so sharp that they could puncture the tires of an automobile running over them.

The red crabs are just one of the 15 species of land crabs that live on the island. Among them is the world's largest crab, the giant robber, or coconut crab. They weigh up to seven pounds.

> ***"Christmas Island is in the Indian Ocean, 220 miles south of its nearest neighbor Indonesia . . ."***

The island also ranks as one of the world's great seabird habitats, according to Australian conservationist John W. Hicks. Of the eight kinds of birds which breed there, three—the Christmas Island frigate bird, Abbott's booby, and the gold bosun bird—breed nowhere else.

In addition, of the some 200 different flowering plants growing on the island, about 30 are endemic.

To preserve those distinctive plants, birds, and crabs, a six square mile national park was established in 1980.

A Little Geography

Christmas Island is in the Indian Ocean, 220 miles south of its nearest neighbor Indonesia, 1,000 miles north and slightly west of the mainland of Australia. It is 12 miles long, 3.5 to 9 miles wide, and it is a 55-square mile top of an undersea mountain.

The island's central plateau is about 1,000 feet high. Rain forest covers three-fourths of the island, fed by as much as 100 inches of rain a year. Temperatures range between 75 and 85 degrees.

Most of the coastline consists of cliffs up to 600 feet high. There are a few sandy beaches and some small bays. Flying Fish Cove is the island's lone port.

Who's There?

Only about 1,000 people live on Christmas Island. The majority are Chinese and Malays; most of the others are from Australia, New Zealand, and India. Just three years ago, before mining declined, there were around 3,000 residents.

Unemployment is high. In 1985, the government started retraining programs to help islanders find jobs in Australia. A "Resettlement Scheme" provides incentive payments to encourage residents to move off-island.

Until just 100 years ago, the island was uninhabited. The first residents came in 1888—14 British adventurers. The coconut palms they planted still stand along the beach.

In 1895, large deposits of phosphate were discovered. A British company started mining there two years later.

During World War II, the Japanese occupied the island. In 1946 the island became part of the Colony of Singapore. The mining company was bought by Australia and New Zealand in 1948, and ten years later, the island became an Australian territory.

In 1963, Christmas Island began issuing its own stamps. They are especially colorful and attractive. Some show the early sailing vessels and sail-and-steam ships which visited the island. One 1980–81 series shows 16 steps of mining—drilling, drying, crushing, etc. While the stamps are avidly sought after by many collectors, they have not yet become particularly valuable. In a single year, the stamps brought more than a half-million dollars to the island.

For resident Europeans, the center of social life is the Christmas Island Club, featuring a swimming pool, tennis courts, and movies. Other island attractions include a nine hole golf course, cricket club, and, on Phospate Hill, a building known island-wide as the "Ham Shack."

Two Christmas Islands

Hams around the world know the island as VK9. The current *Call Book* lists just two stations on the island, and one of those is the club station. Still, the island is on the air enough so that it didn't make the latest list of "100 most wanted DX stations," compiled by *The DX Bulletin.*

One caution: This Indian Ocean Christmas Island is often confused with the other Christmas Island, the one in the South Pacific, located 1,300 miles south of Honolulu. This South Pacific Christmas Island is the largest of the 33 islands of the Republic of Kiribati.

Dedicated DXers never confuse the two islands—hams on the South Pacific Christmas Island use the East Kiribati prefix T32, which counts for the country of Kiribati, not for the "country" known as Christmas Island.

Number 30 on your Feedback card

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WRITTEN EXAMS SUPEREASY. Memory aids from psychologist/ engineer cut studytime 50%. Novice, Tech, Gen: \$7 each. Advanced, Extra: \$12 each. Moneyback guarantee. Bahr, Dept 73-9, 2535 Marietta, Palmbay FL 32905. BNB624

COMMUNICATIONS BATTERIES NiCd Packs/Inserts/Rebuilding. Exact Replacement Packs: Yaesu FNB2 / Wilson BP4 \$22.95, Santec 142/1200(3 pin) \$23.95, Motorola: HT220-Slim \$29.95, HT220-Omni \$34.95. Battery Inserts: ICOM: BP2/Rap \$18.95, BP3/CM3 \$16.95, BP5/Rap \$24.95, BP7/BP8/Rap \$29.95, Kenwood: PB21 \$13.95, PB24 \$21.95, PB25/25H/26 \$25.95, Azden: 300 \$21.95, Standard BP1/C118 / Pace MX-BT2 \$25.95, Tempo S1/270 \$23.95, S1,2,4,5,/450 \$23.95, S15 \$24.95, Yaesu: FNB3/3A \$32.95, FNB4/4A \$33.95, TenTec 2991 \$24.95, Santec: KTBP \$16.95, KTBP2 \$23.95, KTBPH \$24.95, Rebuilding: ICOM/Ken/Yaesu/T-T add \$4.00 to insert prices. Others available. SASE/free catalog. In PA add 6%. For MC and VISA, add \$2/order. Phone: (814) 623-7000. Add \$3 Shipping/order. CUNARD ASSOCIATES, Dept. 7, R.D. 6 Box 104, Bedford PA 15522. BNB628

ROSS \$\$\$\$ NEW December SPECIALS: KENWOOD TS-680S, \$929.90; TS-940S/WAT, \$2069.90; TH-215A, \$324.90; TH-315A, \$299.90; TR-651A, \$614.90; AZDEN PCS-6000, \$369.90; ALINCO EP-2010, \$99.99; AEA PK-64S/HFM, \$149.99; ICOM IC-471A, \$689.99; IC-228H, \$463.99; IC-3200A, \$468.99; IC-2AT, \$248.99; IC-761, \$2309.90; Yaesu FT-209RH, \$276.99; YR-901, \$549.99; FT-747GX, \$674.90; MFJ-989B, \$309.90. ALL L.T.O. (Limited Time Offer) LOOKING FOR SOMETHING NOT LISTED?? CALL OR WRITE. Over 8780 ham-related items in stock for immediate shipment. *Mention ad.* Prices cash, F.O.B. PRESTON. WE CLOSE AT 2:00 SATURDAYS & MONDAYS. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, (P.O. Box 234H), PRESTON ID 83263. 208-852-0830. BNB654

COMPUTER CODE PROGRAM for IBM PC. New. Does most everything! Best value. \$12. Moneyback guarantee. Free details: SASE. Bahr, Dept 73-9, 2535 Marietta, Palmbay FL 32905. BNB691

CHASSIS AND CABINET KITS SASE; K3IWK, 5120 Harmony Grove Road, Dover PA 17315. BNB698

CALL SIGN BADGES: Custom license plate holders. Personal, distinctive. Club discounts. SASE. WB3GND, Box 750, Clinton MD 20735; 301-248-7302. BNB699

ROSS \$\$\$\$ USED December SPECIALS: KENWOOD SM-220, \$329.90; TR-9500, \$439.90; VFO-240, \$159.90; TR-3600A/TU35B, \$279.90; PS-30, \$124.90; HENRY 2K, \$695.90; S-4T, \$149.90; ICOM IC-471H, \$799.90; IC-271H/WPS-35, \$799.90; R-71A, \$698.90; IC-740/W,PS-35,EX-242,241,FL-45, \$695.90; ROBOT 400, \$299.90; YAESU FT-747GX, \$679.90. LOOKING FOR SOMETHING NOT LISTED?? CALL OR WRITE. WE HAVE OVER 315 USED ITEMS in stock. *MENTION AD.* PRICES CASH, FOB PRESTON. WE CLOSE AT 2:00 SATURDAYS & MONDAYS. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, P.O. BOX 234H, PRESTON ID 83263; 208-852-0830. BNB709

DIGICOM>64: C64 PACKET See AUG. 88 *73 Magazine* (by W2UP) for circuit and software details, or write us for more info. Order #154-KIT for kit with disc at \$49.95 or #154-ASY for assembled board and disc at \$79.95. Add \$2.50 S&H per order. A & A Engineering, 2521 W. La Palma, #K, Anaheim, CA 92801; 714-952-2114. BNB732

HAM TRADER YELLOW SHEETS. In our 27th year. Buy, Swap, Sell ham radio gear. Published twice a month. Ads quickly circulate–no long wait for results. Send #10 SASE for sample copy. \$13 for one year (24 issues). P.O.B. 2057, Glen Ellyn, IL 60138-2057. BNB741

\$\$\$\$\$ SUPER SAVINGS \$\$\$\$\$ on electronic parts, components, supplies, and computer accessories. Free 40-page catalog for Self Addressed & Stamped Envelope. Get on our mailing list. BCD ELECTRO, P.O. Box 830119, Richardson TX 75083 or call 214-343-1770. BNB749

HAM RADIO REPAIR, all makes, models. Experienced reliable service Robert Hall Electronics, Box 280363, San Francisco, CA 94128-0363; 408-729-8200 BNB751

HAM HOLIDAY in VP5 Join cycle 22 fun from rare DX QTH Turks & Caicos Islands. We supply transceivers, antenna, process license and offer accommodations as low as 7 nights \$390 each double occupancy in private bungalow. Direct Pan Am service, 80 minutes Miami. Details VP5D, P.O. Box 100858, Ft. Lauderdale FL 33310 BNB760

WANTED: Ham Equipment and other property. The Radio Club of Junior High School 22 NYC, Inc., is a non-profit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of ham radio to further and enhance the education of young people. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax-deductible contribution. We sponsor the "Classroom Net" on 7.238 at 1200 UTC daily and encourage your QSL for our weekly award. Please write us at: PO Box 1052, New York, NY 10002, or call our round-the-clock hotline: (516) 674-4072. Thanks! BNB762

COMPUTER CODE COURSE. Apple II +/c/e/GS, C-64/128. 37 Modes, Graphics, 1–100 WPM, menus, proportional spacing, variable frequency, more (\$29.95). With wordprocessor (\$39.95). Manual (\$10). Check/MO. LARESCO, POB 2018-ST, Calumet City IL 60409. 1-312-891-3279. BNB764

INDIVIDUAL PHOTOFACT FOLDERS. #1 to #1400, \$4.00. #1401 up, \$6.00. Sam's books, \$7.00. Postpaid. Allen Loeb, 414 Chestnut Lane, East Meadow, NY 11554. BNB766

VHF TO MICROWAVE: GaAsFETs, MMICs, transistors, etc. SASE; WA3IAC, 7148 Montague St., Philadelphia PA 19135. BNB771

HAMLOG COMPUTER PROGRAM Full features. 17 modules. Auto-logs, 7-band WAS/DXCC. Apple \$19.95. IBM, CP/M, KAYPRO, TANDY, CR8 \$24.95. 73-KA1AWH, PB 2015, Peabody MA 01960. BNB775

KITS*PARTS*PLANS We have hard to find parts! Variable Tuning Capacitors, Tuning Coils, Crystal and Magnetic Headphones, Germanium Diodes, Crystal and Shortwave Radio Kits. Yeary Communications, 12922 Harbor #800-B, Garden Grove, CA 92640. BNB786

WANTED: Sunair GCU-910A or GCU-935 Antenna Coupler. Ray Dunham, 1030 Hillside Ave., Pacific Grove CA 93950. BNB790

QSLs: Quality at a reasonable price! Satisfaction Guaranteed. Send \$1 for samples and coupon worth \$2. The Sugarloaf Print Shop, PO Box 563, Sugarloaf, PA 18249. BNB791

ELECTRON TUBES: All types & sizes. Transmitting Receiving, Microwave... Large inventory = same day shipping. Ask about our 3-500Z special. Daily Electronics, PO Box 5029 Compton, CA 90224. 600-346-6667. BNB792

KENWOOD 430s OWNERS! Stop Scan stops the scanner on busy frequencies resumes scanning automatically after an adjustable 1–10 second delay. SASE for 1989 catalog. \$19.95 kit. \$29.95 assembled. \$3.50 shipping. JABCO ELECTRONICS, R1 Box 386, Alexandria, IN 46001. BNB794

VOICEGATE communications noise reduction with audio squelch, noise reduction, VOX cassette recorder control, 3 adjustable audio filters, & more! SASE for 1989 catalog. \$3.50 for demo tape. \$109.95 complete (till 1/1/89). JABCO ELECTRONICS, R1 Box 366, Alexandria, IN 46001. BNB795

LEARN CODE using your IBM PC or compatible (256KB RAM). Easy to follow menu-driven program on DS/DD floppy disk fully prepares you to copy 5 WPM for Novice license to 50 WPM, exceeding all license requirements. Features include adjustable *intra/inter*character timing with 1 WPM to 50 WPM sending rate, keyboard-selected character generation and randomly generated letters, numerals, all FCC required punctuation/signals and mixed character types. \$11.00 including shipping. *LOGICON*, PO Box 426, Lexington Park MD 20653. BNB796

continued on p. 88

Barter 'N' Buy advertising must pertain to ham radio products or services.

☐ **Individual (noncommercial)** .... **50¢ per word**

☐ **Commercial** .... **\$1.50 per word**

Prepayment required. *Count only the words in the text. Your address is free. 73* cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue. Please print clearly or type (double-spaced).

No discounts or commissions are available. Copy must be received in Peterborough by the first of the second month preceding the cover date. Make checks payable to *73* Magazine and send to: Rebecca Niemela, **Barter 'N' Buy, *73* Magazine, WGE Center, Peterborough NH 03458.**

WANTED: Dead Tempo 2020 for parts. Dan Giles VE7QM, RR3 Harrison Ave., C-6, Ganges, BC, V0S-1E0. BNB797

R-390A RECEIVER PARTS: Info. SASE. CPRC-26 military Manpack Radio, 6 meter FM, with antenna, crystal, handset: $22.50, $42.50 pair. Military-spec TS-352 Voltohm/Multimeter, leads, manual: $12.50. $4.50/piece shipping, $9 maximum. Baytronics, PO Box 591, Sandusky OH 44870. BNB798

MACINTOSH Ham Software. MacTrak™ tracks satellites, sun, moon. Graphic or tabular outputs. Compatible with Mirage Tracking Interlace for rotor control, $49.95. DX Helper™ provides DX info including distance, bearing, sunrise, sunset, propagation MUF, great circle display, more, $24.95. SASE for info from R. Stegemeyer, P.O. Box 1590, Port Orchard WA 98366. BNB802

HOME-BREW PROJECTS LIST SASE to WB2EUF, Box 708, East Hampton NY 11937. BNB805

QSLs & RUBBER STAMPS—TOP QUALITY! States, World Maps, USA, Key, Shuttle, Globe QSLs. Report Form Rubber Stamps. More! Samples, $1.00 [Refundable With Order]. Ebbert Graphics D-7, Box 70, Westerville OH 43081. BNB807

ELECTRONIC WEATHER STATION. Superb bargain while they last. The one you've wanted, as featured in Popular Science Magazine, provides more than 20 functions, including barometric pressure. Complete system currently retails for $389. **DISTRIBUTOR CLOSE OUT price, only $169.** Includes full service and original warranty. Satisfaction guaranteed. VISA, Master Card accepted. Hurry, call now for details and pre-holiday delivery; 201-531-4615. BNB808

PARTS & KITS for the Home-Brew Amateur. Two First Class Stamps for Latest Catalog & Flier. Small Parts Center, 6818 Meese Drive, Lansing MI 48911. BNB809

HAVE OCTOBER 1960 and JANUARY 1961 ISSUES to best offer. W7IXN, 14915 SE 47 Court, Bellevue WA 98006. BNB810

FLOOD YOUR MAILBOX! You get 100's of radio & electronics specialty catalogs. Send $2.00, name & address to: Electronic List Services, Dept. B, PO Box 1683, Brookline MA 02146. BNB811

QUALITY QSL CARDS, rubber stamps, envelopes and printed letterhead. Send 45¢ postage or SASE for samples. Large selection at attractive prices. Sandollar Press, PO Box 30726, Santa Barbara CA 93130. BNB612

LOOKING FOR HAMS WORLDWIDE? Subscribe to *QMT*, an English-written ham quarterly where subscribers are entitled to place one free ad (max. 80 words) which is published for subscription period. Over 2,500 ham ads quarterly. 87 countries. Subscription rates (CASH): 5-year $20.00; 3-year $15.00; 1-year $10.00. Price includes p&h. Enclose name, call, address, and advertisement (non-obligatory). Order before Jan. 5 and get free gift. Paulo Lago, (Lyon Publications), Apartado 2804, 1121 Lisboa codex, Portugal. BNB813

WANTED: Azden PCS-4500 Regency HR-6, or Genare GTX-600. Reasonable. Jim, 469 Jayson Avenue, Pittsburgh PA 15228. BNB814

WANTED: Yaesu FT-625RD, FT-627RA, or FT-680R. Also wanted: ICOM IC-505, IC-551, IC-551D, IC-560, or IC-502A. Reasonable. Jim, 469 Jayson Avenue, Pittsburgh PA 15228. BNB815

SLEP SPECIALS, MILITARY USM-117C SOLID STATE SMALL PORTABLE DC-5MHz OSCILLOSCOPE, IDEAL FOR BENCH WORK OR RTTY/MODULATION TESTING $95.00; MILITARY USM-207 SOLID STATE PORTABLE, 0-500MHz EIGHT DIGIT READ-OUT, HIGH STABILITY OSCILLATOR, LATE MILITARY LAB QUALITY $185.00; TS-403/U MICROWAVE SIGNAL GENERATOR, 1.8GHz THROUGH 4.2GHz, MIL/SPEC VERSION OF HP616B $195.00; TS-510A/U SIGNAL GENERATOR 10MHz THROUGH 420MHz, MIL/SPEC VERSION OF HP608D $195.00; HP614A SIGNAL GENERATOR 900MHz TO 2100MHz $285.00; HP606A SIGNAL GENERATOR 50 kHz THROUGH 65MHz $295.00; HP417A VHF DETECTOR 10-500MHz $85.00; HP618B SIGNAL GENERATOR 3.8GHz TO 7.8GHz $295. ALL LAB TESTED, PRICED LOW TO MOVE QUANTITY, SATISFACTION GUARANTEED. VISA, M/C, OR CHECK, ADD SHIPPING, WRITE OR PHONE BILL SLEP, 704-524-7519, SLEP ELECTRONICS COMPANY, HIGHWAY 441, OTTO NC 28763. BNB816

COMPUTERIZE with the "Amateur Radio Operating System." This MS/DOS based software features auto-logging, QSL management, AWARD summaries, Contesting, and MORE. Base System $39.95, Demo disk $10.00 (credited). SASE brings details. Fun damental Services, 1546C Peaceful Lane, Clearwater FL 34616. BNB817

FREE HAM EQUIPMENT, details $1. P.O.B. 1631, Arvada CO 80001. BNB818

INEXPENSIVE VIDEO DIGITIZER "THE IMAGE-IZER" from KINNEY SOFTWARE. See *73* Oct. 1988 page 10 for details. Capture RS170 TV video (VCR or TV camera) to Commodore 64/128 or IBM PC. Save images to disk files. IBM PC/XT 4.77MHz version requires CGA capability- $59.95. Commodore version- $39.95. Includes disk software, documentation, pretinned and drilled PC board for easy assembly. Uses common, low cost parts. Specify computer type. Order from: KINNEY SOFTWARE DEPT. 73V, 974 HODSDON ROAD, POWNAL ME 04069. BNB819

INEXPENSIVE SLOW SCAN SEE WHAT YOU HAVE BEEN MISSING! Either IBM PC/XT/AT or Commodore 64/128 version only $39.95! Receives all popular SSTV modes, including 36 second color ROBOT, in 8 grey levels. Save images to disk. Commodore version also transmits black and white pictures. IBM version is receive only (requires CGA capability). Includes disk software, documentation, pretinned and drilled PC board for easy assembly. Uses common, low cost parts. Specify computer type. Order from: KINNEY SOFTWARE DEPT. 73SSTV, 974 HODSDON ROAD, POWNAL ME 04069. BNB820

WANTED DRAKE R4245 or R7A well optioned for SWL and AM/SSB DXing in excellent condition in exchange for some cash and collection of mint New Zealand stamps, details Ron. Harkness, 24 Talbot Place, Invercargill, New Zealand. BNB821

TECH TIPS

Pearls of Tech Wisdom

PS Fix for the PK-232

The AEA PK-232 is a very popular terminal unit. I've had mine for a year now. Recently, though, it developed a problem. The Pakratt sometimes lost its presets in memory, even though the memory backup batteries checked out OK. The three LEDs on the left side of the display lit up randomly. The unit sometimes locked up and didn't print a thing.

I soon found out that the problem was in the voltage regulator connection to the circuit board. A screw with lock washer and nut at the bottom of the board loosened up, due to the heat sink temperature. This screw connects the output of the regulator from the heat sink tab to the circuit board. Tightening down this screw improved the connection, but there is a better way and permanent fix to this problem.

To make a permanent fix, solder a wire to the center tab of the LM-317T voltage regulator and the other end to the anode of diode D12. If the tab is cut off too short, you will have to replace the IC with a new one. (Radio Shack has them in stock.) Apply heat sink compound to the regulator IC before mounting it to the heat sink unit. To remove the circuit board from the chassis, unscrew the six screws on the top of the board and the knob, and nut on the threshold pot on the front of the unit. The board will then lift out (don't bend any of the LEDs). You may have to hold the screws on the bottom from turning to loosen up the top ones. After you are done with the modification, carefully replace the board and align it, then replace the six screws, nut, and knob.

Recheck connections before applying voltage to the unit, then fire it up. Be sure the memory batteries have been replaced. You will get the AUTOBAUD message asking to print an "*" to set the RS-232 port. The BAUDOT LED will be lit. Reset the missing presets. Turn off the unit, unplug the power then replace the top of the metal cabinet and the six screws. Now, install the unit as before and plug in the power and RS-232 cable and you're ready for problem-free operation.

Remember to observe safety precautions when working around ICs to prevent static shock damage, and watch your soldering to prevent shorts and damage to the printed wiring.

I love my Pakratt and have been very satisfied with its performance. Although you may not have this problem for a while, it will eventually come up, so don't pull your hair out until you check this regulator connection. What seems like a complex problem may be this simple. Here is the corporate address if you need them for advice or IC upgrades. *AEA Inc., Units O&P, 2006 196th S.W., Lynwood, WA 98036; (206) 775-7373.*

Robert Fisher KF6DF
5994 Arden Ave.
San Bernardino, CA 92404

Lightning Protector

As I settled the dust in the new shack, I found that my previous lightning protect system was inadequate. I sifted through the materials that had been pack-ratted away and came up with a system that satisfied my needs.

The materials I used were: a sheet metal box, measuring 7" cubed, enough SO-239s for each of the antenna systems I have, copper braid stripped from old coaxial cable, star washers and nuts to secure the SO-239 to the box, solder and soldering iron, and a drill.

On the bottom of the sheet metal box, I drew a pattern of the SO-239s, leaving enough space between each to allow securing with star washers and nuts. I also left enough room to label each one. I then drilled the patterns and reamed the holes to take off any sharp edges. I connected the SO-239s in series by soldering the end terminals to the copper braid. A short strip of braid was cut and soldered to the shielding coupler of each SO-239, to insure complete grounding. I cut a longer strip of copper braid long enough to reach the ground rod outside the shack. The series of SO-239s then fed through the open end of the box, so the threaded end protruded through the predrilled patterns. The SO-239s were then secured with the star washers and nuts and labeled. The longer strip was run to the ground rod and secured with a clamp.

This system saved me the cost of buying commercially made lightning arresters and splicing my coaxial cable. Now when the thunder starts to rumble, I simply screw my coaxial connectors to my home-brew lightning arrester and pray like everyone else that I don't take a hit. I do feel better, however, knowing that, if I do take a direct hit, the energy will not travel to my radio gear. I would rather replace my antenna system than expensive radios.

Jim Sammons N1FID
Route 2, Box 3530
Jodie Lane
Fairfield Center, ME 04937

Have a Tech Tip? Send it in! Authors of printed Tech Tips receive a free one-year subscription to *73 Magazine*.

LOOKING WEST

Continued from page 83

and those capable of distributing the net on the bands were granted assignments. With the number of bridge ports limited to 70, no individual hams were given special treatment.

The crowning link to all this was donated by Bill Duval K5UGM of Irving, Texas. Bill arranged the donation of uplink and air time on KSAT satellite radio. KSAT is on the ATT Telstar 303 communications satellite on Transponder 19. With the addition of KSAT to the quickly filling teleconference bridge, it appeared as if the distribution was complete.

Art wasn't sitting on his laurels. He managed to secure the facilities of the Satellite Music Network in Mokina Illinois. It is state-of-the-art: a full-blown Auditronics mixing console, audio cart machines, telephone hybrid interconnect, and an all-volunteer engineering and production staff.

First chosen for the panel of experts was ARRL Counsel Chrisopher D. Imlay N3AKD. Chris practices his profession in Washington and probably has a better understanding of how the Commission functions then anyone else in the League. From *Ham Radio Magazine* came its Associate Editor Joe Schroeder W9JUV.

Hurt more then any others are the packet radio users. They are the fastest growing subculture in the modern world of amateur radio and were depending on 220–222 MHz to become the backbone of a real-time, coast-to-coast, border-to-border emergency communications network. A network, that due to channel loading elsewhere on 220 and on all other suitable VHF and UHF bands in urban areas, will now never come to be. Thanks to Steve Goode K9NG in Illinois, their position was well-addressed during the NTRN.

Ed Gray WØSD in Salem, South Dakota and Roger Cox WBØDGF in Lincoln, Nebraska elo-quently addressed the needs of the EME and weak signal operators.

FM isn't unaffected by this reallocation move. The job of making sense out of this falls to the nation's frequency coordinators. Everyone that now operates below 222 MHz, must be redistributed into the urban sprawl above 222. Thus Karl Pagel N6BVU, president of the 220-SMA frequency coordination group, came to be a part of the interactive panel. 220-SMA, however, represents the "western view" so for balance we prevailed on Gary Cantor WA2BAW of the the Tri-State Amateur Repeater Council.

Finally, the Condor Connection. This NTRN, through the outspoken Mark Gilmore WB6RHQ, told the country about the world's largest 220 MHz open intertied repeater network. This is a radio network that permits hams throughout California and Nevada to talk to each other as if they were next-door neighbors. This legendary system relies totally on the 220–222 MHz band to interlink its sites. This system, which has served in numerous emergencies, will disappear if the reallocation is permitted to proceed. Due to overcrowded conditions on other bands, there's no place for it to move.

I have never seen such cooperation between the various and sometimes highly divergent factions of the amateur community. While each speaker represented a particular point of view, the theme throughout the 2 hours of on-air activity kept coming back to what people like Joe Merdler N6AHU, had hoped for. One of unity, of purpose, and an ongoing determination to do all that is within the power of man to keep 220–225 MHz and every ham band for the use of amateurs only.

The NTRN's message to the FCC and the business community is clear: *"We are as one and we mean business!"*

Look for details on this NTRN, and info on future ones. Happy Holidays from the night shift in LA! 73

73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

***Air mail subscriptions** are beginning for established Hambassadors to 73 International! New Hambassadors' subscriptions will graduate to air mail on the January after their first year's third report (third of the three Hambassadors send in each year). This will improve report follow-ups and help keep information as much up to date as is possible in a monthly magazine. And Hambassadors will be the most up-to-date readers in their countries!*

***Callbook editors around the world:** See the first item in the report from Israel, below. And even before receiving his October issue with the first revision of **The 73 International Universal Permit Application**, 4X1MK (not 4X11MK, as mentioned in it!) has sent in some good news. Thanks to the good offices of the Israel Amateur Radio Club (whose Membership Services volunteers will do the work), visitors to Israel wishing to make good their reciprocal licensing privileges no longer will have to show up in person at the Ministry of Communications in Tel-Aviv.*

Here's why. Send the IARC (PO Box 4099, 61040 Tel-Aviv, Israel) a photocopy of your valid license, a photocopy of the first page of your passport (with your photo on it), and a check or M.O. for the amount of US$12 (the Ministry is not authorized to receive foreign currency, so the IARC does the conversion) and the following information: Family name, previous family name (if changed), first name(s), father's name, place and date of birth, country of previous residence, present address, last address, occupation, present and previous places of employment, passport number and country. State expected date of arrival in Israel and equipment to be used: make, model number, frequency range, power output, and types of emission.

Your reciprocal license will be kept for you at the address of your choice here, OR, if you send the IARC the materials far enough in advance ("Give us a few good months!" writes Ron) the license will be mailed to your home address. (Ron's regular report follows in this issue.)

December's special days to mention in your QSOs: 1—National Day, Central African Republic (5th for Thailand, 17th for Bhutan), and Anniversary Day, Portugal (30th for Madagascar); 2—National Holiday, United Arab Emirates (3rd for Laos); 5—Discovery Day, Haiti; 6—Independence Day, Finland (7th for Ivory Coast, 9th for Tanzania, 11th for Upper Volta, 12th for Kenya, 16th for Bahrain); 10—Human Rights Day, Equatorial New Guinea; 13—Republic Day, Malta (18th for Niger); 15—Statue Day, Netherlands Antilles., Bill of Rights Day, USA; 23—Victory Day, Egypt; 25—MERRY CHRISTMAS TO ALL!; 26—Boxing Day, Canada, Great Britain; 27—Constitution Day, North Korea; 28—King's Birthday, Nepal.

***Special Calendar Note:** As this is written, in Japan the 63rd year of Showa (meaning "enlightened peace") is in its 10th month. There may not be a 64th year, because the 124th Emperor, Hirohito, is gravely ill, and an era with a new designation will begin Year One with the reign of Crown Prince Akihito. Autumn festivals have been cancelled in that nation, so in your QSOs with Japan on November 23rd, rather than sending "Labor Thanksgiving Day" greetings (as listed on last month's international calendar) it will be more appropriate to express condolences. Sympathy will be appropriate for the entire time of mourning—which could be as long as a year—for the period will be a sad one for the Japanese. Rice will be planted on sacred ground when Hirohito dies, and Akihito will eat its harvest in a ceremony which completes the rites of accession, whereupon he becomes Emperor fully and in every way.—CCC*

Willis Island's current total population. L to R: P. Giese, C. Clark (radioman), P. Dawson (the O.I.C.), and D. Webb.

AUSTRALIA

The following is from the last report sent in by Jim Joyce VK3YJ before he retired as Australia's Hambassador to 73 International. (The WIA should be naming his replacement soon.) We call his story "Four Men and an Island—Weather from Beyond the Outback."

> ***"Willis Island—the site of one of the most remote 'Observing Offices' of Australia's Bureau of Metereology."***

It is a tiny outcrop in the Coral Sea 400 km east of Cairns, a mere speck in the ocean. (If Australia is thought of as the face of a clock, Cairns is at 0200.) It is 400 meters long, 100 meters wide, and 9 meters high. The population of the island is 4. The morning paper sometimes drops down out of the sky; the island is bombed (with food and supplies) every six months.

This is Willis Island—the site of one of the most remote "Observing Offices" of Australia's Bureau of Meteorology. It is staffed for six months at a time by a team of three Observers and one Radio Operator/Technician, whose reports are used in the tropical cyclone warning system.

On November 8, 1988, Willis celebrated the 67th anniversary of its establishment. It has come a long, long way since the first team stepped ashore onto a bare, windswept island, inhabited only by birds and turtles.

Davis, the Australian Antarctic Station, was named for the Commander of the *Aurora* of the 1911 Australasian Antarctic Expedition, and Captain John King Davis was also responsible for the Willis Island station. As Commonwealth

Pilot's-eye view of Willis Island on the run-in for a drop.

Director of Navigation, he saw its forecasting value since it sat in the cyclone-prone waters of the Coral Sea. In September of 1921, he rode over governmental objections that the cyclone season was less than two months away by volunteering to lead the first party himself. Davis didn't fool around, and one month later the steamer *Innisfail* dropped anchor off Willis and unloaded a 15-man party and 150 tons of cargo.

Sixty-seven years later Willis has established coconut trees for welcome shade, well-kept lawns around the buildings, and concrete paths to the weather-balloon launching area, the radar, and the beach. The beach is *not* a place to go to swim, however. By official decree, the ocean is reserved for the large shark population and other marine life.

A large cool room and four freezers ensure fresh foods, and off-duty hours are made pleasant by TV from Cairns or Townsville, video cassette films, hi-fi music, billiards, table tennis, and a well-stocked library. Additional amusements Captain Davis wouldn't have believed are (1) the mid-duty-term "bombardment" of food, supplies, and what *really* can be called air mail, by the Royal Australian Air Force, and (2) unheralded over-flights by reconnaissance planes which often swing by to drop the latest papers. Rumor has it that bets are made regularly on how close to the front door the pilots can deliver a morning paper!

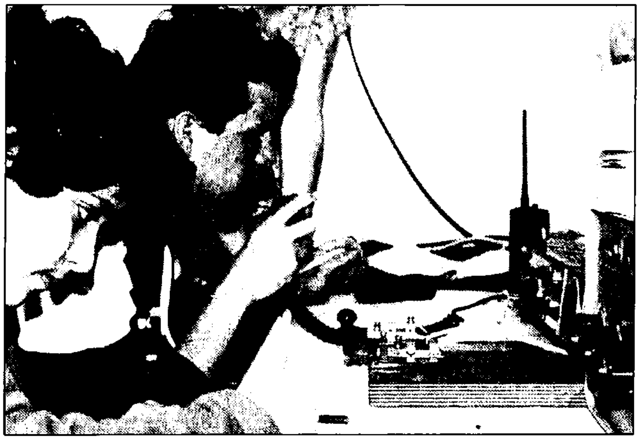
(*Next installment: Amateurs on Willis Island.*)

Jim wishes to express his appreciation for their help in his report on Willis to Ken McLachlan VK3AH, Dave Shaw VK3DHF, Dr. Peter Barclay VK3FR, Reg Carter VK3CAZ, and Bureau of Meteorology staffers Trevor Farrar (PR Officer), Michael Joyce (Weather Observer), and the Bureau's house jounal, Weather News.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
Negev Mobile Post Office
85530 Israel

A request from the Soviet Union has come to me. Alex Lavrenchenko UM8MRG, QSL Manager for the UM prefix, the Kirghiz Republic, would like his address to be known to all the callbooks around the world. It seems to me that 73 International is a good place to pass this on. It is PO Box 392, Frunze–55, Kirghiz 720055, USSR.



Eyat 4X6TC (right) makes contacts from 4X40R in Jaffa (one of the four commemorative stations for Israel's 40th Anniversary) while Nir 4X6RK logs and fills out OSL cards. (Photo by 4X1MK)

Congratulations to the Israel 40th Anniversary Contest winners! Nearly 400 logs were received from around the world, and over 150 different Israeli calls were logged during the 24-hour period last April. (Complete results may be had from the IARC using the above address, for the price of return postage.)

In Europe the top three were I5VIT first, SP2FAP, and OH7RS; in Asia, JA1BNW, JA7HMZ, and VU2UR; Africa: EA9GS, EA8ABG, and EA9IB. From South America: LU7EVL, PY5EG, and LU1JDL; and from North America: K1MEM, K3ZO, and W4MLA. The first three Israeli single ops were 4Z4YX (4Z4KK), 4X6UU, and 4X1MJ.

Fox hunting DFing gains momentum here, perhaps glorified by the catching of "Dr. Bereleh," the Tel-Aviv jammer (see my August column, "The Phantom Unmasked.") In July in the Haifa area, Moshe 4Z4GM played the fox on 2 meters and finally was caught on the walls of the ancient city of Acre. The Holon Bat-Yam Club (just south of Tel-Aviv) plans a hunt on 80 meters.

The packet explosion has been such that the 4X4HF BBS in Haifa received more messages and files than its memory capacity, hampering operations. Just two short years ago its planners never imagined such widespread use.

In July of 1987, **Amir Bazak 4X6TT started a year-long around-the-world DXpedition.** In eleven months he made 67,000 QSOs from 18 countries, visiting 22, neglecting no modes, and giving many of us new countries for our DXCC collection. (Don't confuse Amir with Barukh 4Z4TT, who close to a decade ago put some rare ones on the air in the Pacific area! They're two different chaps!)

Some of the calls Amir put on the air were HS0B, XX9TTT, N4MJH/DU8, 4X6TT/DU1, XX9T, VK3ETT, AX3ETT, AX9L, VK3ETT/VK9, ZL0ACF, 4X6TT/FW0, T2STT, T27DX, 5W1TT, 4X6TT/KH8, and 4U1UN. Not bad at all! Amir is taking care of his own QSLing, and cards can be sent to his home address in the International Callbook. Just remember to send return postage! There is no way this young man can handle the mailing of cards from his own exhausted pocket!

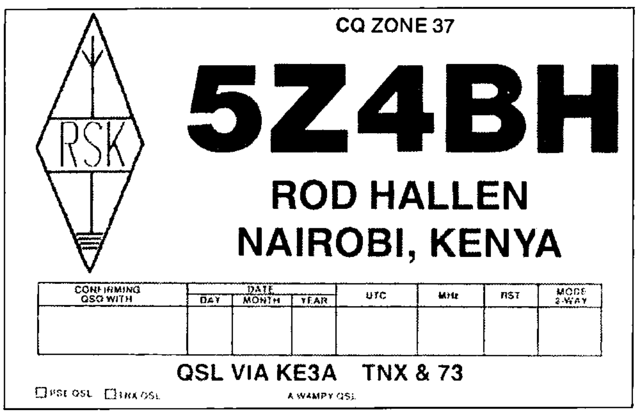
To the best of my knowledge, **Ralph 4X6IF is the first Israeli station to make Earth-Moon-Earth contacts.** Using four stacked Cushcraft "Boomers" fed by a kilowatt, the first historic QSO from Israel using the moon as passive repeater on the half-million mile route (!) was made with W5UUN on June 1 this year. If you want to work Ralph, chances are it won't be on the conventional bands, no siree! Check out 2 meters or 70 centimeters–satellite, EME, or Sporadic E. Ralph likes to sweat for his DX!

KENYA

Rod Hallen 5Z4BH
Box 55
APO New York 09675

[*We welcome KB7NK (take a deep breath: ex- 9G1RT, C5AZ, 5T5AZ, TL8AZ, TU4BB, EL2AE, 3D2RH, ZL0AGS, VK2EFI, VK1HR, /5NO /VS6 /DU1, WA7NEV, WB6BOW) as our roving East Africa Hambassador (see last month's Kenya* **Roundup** *item). He will be traveling there extensively for the next four years and hopes to operate from many countries. (Bill KE3A will be his QSL Manager.) Rod is a Regional Communications Officer with the American Embassy in Nairobi; he has been a ham since 1962, and was an Associate Editor of* Kilobaud *(later* Microcomputing*) around 1978.—CCC*]

Kenya celebrates its 25th Anniversary this month (December) and will be using the special prefix 5Z25 (so I will be 5Z25BH). On October 14 and 15, Kenya was represented on the Boy Scout Jamboree on the Air by 5Z4LBP (LBP=Lord Baden Powell, Boy



CQ ZONE 37

RSK

5Z4BH

ROD HALLEN
NAIROBI, KENYA

CONFIRMING QSO WITH	DATE DAY	MONTH	YEAR	UTC	MHz	RST	MODE 2-WAY

QSL VIA KE3A TNX & 73

☐ PSE QSL ☐ TNX QSL
A W4MPY QSL

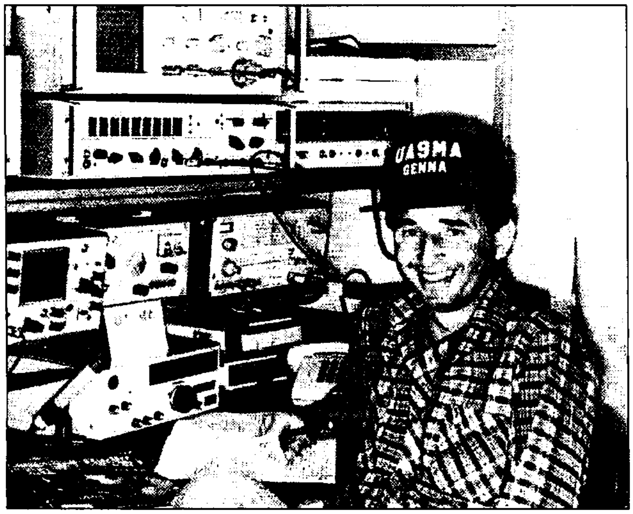
Scout founder), operated by Ted 5Z4OT and Palle 5Z4EJ.

The Kenya Award is issued by the Radio Society of Kenya (RSK). Only contacts made after December 31, 1977 count. Ten points are needed: 2 points for a contact with any 5Z4 member of RSK, 5 points for contact with the RSK club station, 5Z4RS. Any band, any mode, SWLs eligible. Some past and present members of RSK are 5Z4–BG, BH, BJ, BP, DS, DU, EJ, JB, LH, LL, LT, MR, OC, OT, PR, PT, RK, RT, RY, SS, WB, and ZC.

Send a log photocopy witnessed by an official of a local radio society or the licensing authority—QSL cards not necessary—with 10 IRCs or US$5 and a self-addressed adhesive label. Mail to Radio Society of Kenya, PO Box 45681, Nairobi, Kenya. Put KENYA AWARD on the upper left corner of the envelope.

USSR

Gennady Kolmakov UA9MA
PO Box 341
Omsk - 99
USSR



Gennady Kolmakov UA9MA.

[*The following comes from a letter direct from Gena UA9MA and a letter from him written in Russian and sent via Ed Kritsky NT2X for translation. Ed will be helping us out (as an Assistant Hambassadorl) with translations and interpretations, when needed; his help plus our plan to send many Hambassador subscriptions airmail will speed up and make more up to date our reports from far-away countries.—CCC*]

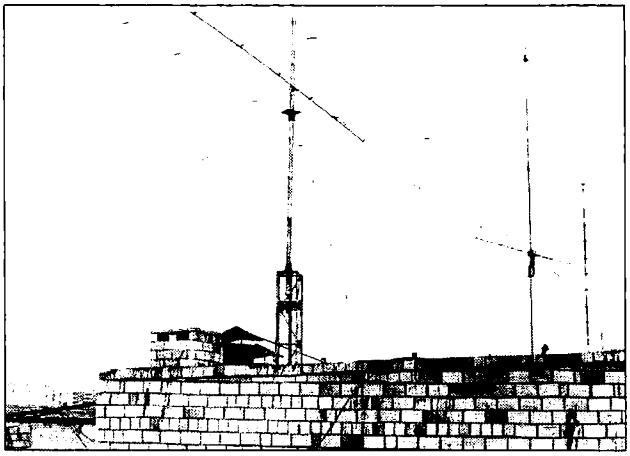
I received the August column with my first report and will send my next one some day! Hi! Also received my first issue of *73 Amateur Radio.* Thank you very much! You made very considerable article with my very short report!

I have been away at a very big contest station for this year's All Asia Contest, RL8PYL. Exact address: RL8PYL, 472300 Kazakh Republic, Temirtau Box 49, USSR. We operated in a multi-multi category, 28, 21, 14 days and 14, 7, 3.5 nights. We made 3500 QSOs, with 300 multipliers and scored approximately 1 million points—at least twice the previous record I think. A special RL1P call was used (and will be used throughout the year).

Lots of stations called us, primarily at night. During the day 20 was dead and 15 good only mornings and evenings. We had a damaged reflector on our 40-meter 4-el yagi and only a vertical loop (delta) on 80 meters. Nevertheless, on 80 we worked 5Z4, ZS, VK, PY, LU, ZP, CX, YB, 5T5, CN8—and all that in the middle of the summer!

The ops there are planning to put up 5 over 5 for 14, 4 over 4 for 7, and a 3-el yagi for 3.5. Big plans. I will be there, multi-multi again, for the *CQ* WW SSB.

The station ops are making plans for a Vietnam DXpedition next year, with UL7PAE, UL7PCZ, RL8PY and one other. It will be sponsored by the Youth Communist League of Kazakh Republic (VLKSM), and a large sum of money has been allotted.



The RL1P antennas, L to R: 36-meter mast with delta loop for 80, the lower antenna of the 28 stack (6 x 6), 6 x 6 el on 21. The op on the tower is, yes, Gena!

In addition to all that, I'm involved with the newly organized West Siberia DX Club, and we hope to have our own bulletin and issue an international award. We also want to have joint US–USSR expeditions, exchange delegates, etc. Many hams in the Soviet Union are now looking into organizing such regional clubs to have such plans implemented.

This year I am planning a serious effort to be among the 10 best "Soviet Sportsmen of the Year," and make the grade of "Master of Sports, International Class." [*The former is a Federation of Radio Sports title awarded those who win a certain number of contest honors. —CCC*]

I am happy to be a Hambassador!—Gena.

[*NT2X tells us that the USSR "has lifted all restrictions" on the sending of all electronic goods and magnetic media (VCRs, PCs, etc.) to the country. Tariffs, which used to be as much or more, even double, the value of items mailed, are now down to 10% to 30% of the value. He also says there no longer is a risk of causing offense if US dollar bills are sent instead of IRCs, which cost $.95 anyway.*

Readers can now QSL directly to Soviet hams and Soviet hams can now QSL directly to hams out of the country. For more information on the lifting of restrictions for Soviet hams. see the August 1988 "QRX" column, titled "No Longer Just 'QSL via Box 88.'"

And see other USSR information in the Israel report, above: "A request from the Soviet Union."

—CCC]

The RL1P team, L to R: UA9MA, UL7PAE ["chief"], UL7PCZ, and the op responsible for computer-duping of logs.

RTTY LOOP

Amateur Radio Teletype

Marc Leavey M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

AMTOR

While sitting in the doctors' lounge at a local hospital, another physician began gesturing to me. Expecting a question about medicine, or at least some hospital gossip, imagine my surprise when he asked me if I were the same Dr. Leavey who wrote *73's* RTTY Loop column! Thanking him for the attention, I sat back as he challenged me with his situation.

He had recently become interested in AMTOR. While he could hear a great number of stations transmitting this mode, he could only obtain copy on a relatively small number of them. He wondered why an AMTOR station of equal signal strength to a conventional Baudot RTTY station, was so much more difficult to copy.

His problem touches on a basic difference between Baudot and AMTOR, representing how the advance from the old to the new sometimes catches a tad in the cracks.

Conventional Baudot or Murray RTTY allows transmission of data from sender to receiver, one way at a time. This is often termed "half-duplex" communication. With data rates typically of 45.45 baud (bits per second), each data pulse lasts at least 22 ms. A noise pulse would have to last a substantial time, perhaps at least 7 to 12 ms, to destroy a data pulse.

Contrast this with AMTOR, in which a special seven level code is transmitted at 100 baud. Here, each data pulse is only about 10 ms wide. Consequently, a much briefer burst of noise can "take out" a data pulse.

Therefore, you may get the impression that AMTOR is a much less reliable medium than Baudot for RTTY transmission. Further, even if characters in Baudot RTTY take a noise hit, they can often be figured out by context. The receiver's brain fills in the missing characters. Thus, if you are looking at a line that says *TO ALL STJTIONS* your brain has little trouble realizing that the third word should be "STATIONS," particularly if you know that Baudot codes for "A" and "J" differed by just one bit. Monitoring a Baudot transmission is no problem. Everyone expects "hits" now and then, and you develop the knack for reading through them.

Perfect Copy

AMTOR, however, has one critical advantage over Baudot—error correction. Each character must meet certain bit matching criteria to be valid. Groups of characters containing an error are as invalid as random noise and are not displayed. The error correction scheme, however, works completely only when two AMTOR stations are in synch with each other—that is, when two stations share the same timing cycle.

Stations receiving AMTOR from another station with which it is not in synch, such as a broadcast station, have only partial error correction. AMTOR broadcast stations typically send each bit bundle twice. If the first comes up as an error on the receive end, the receive station looks for the second bundle. If *that* comes up as an error, then the receive station puts a blank, question mark,or some other symbol indicating the uncorrected error in that character's space on the monitor. Unlike Baudot RTTY, a blank is left on the screen instead of a misinterpreted character.

With a noise-free circuit, the rates of data transmission can approach the maximum data rate being sent. With a noisy circuit, however, the many retransmissions can slow information exchange to a crawl. But the data *will* get through perfectly.

"AMTOR, however, has one critical advantage over Baudot—error correction. Each character must meet certain bit matching criteria to be valid."

Those of you familiar with packet will see a certain similarity between AMTOR and packet, and indeed there is. With packet, the groups are longer and there are other conventions which have been established, but the operating principles are the same.

As with packet, you can command many controllers to ignore error checking, and just display what is received. That is the way to monitor an AMTOR circuit. There are solutions to these problems, though they're not always quite so obvious. It just takes understanding what is going on in a mode to make it work the way you want it to!

We have all kinds of goodies on tap for 1989, folks. From answering all of your questions, to asking a few of my own, I think it will be very exciting. Be sure to let me hear from you, by mail, by CompuServe (ppn 75036,2501) or by Delphi (username MARCWA3AJR). I have had little feedback on a Computer Corner here in the Loop. Let me hear from you. You really do have input into this RTTY Loop! ■

Number 38 on your Feedback card

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
PO Box 1079
Payson, AZ 85541

December 1988

Conditions may be fair to poor on many days during the first and last week of the month. In particular, note the 4th–7th, and again the 26th–29th. The remainder of the month, however, should provide fair to good DX conditions, particularly the period from the 11th through the 22nd. During the fair to poor days, the Earth's magnetic field is likely to be unsettled to active, with the "A" index running well above normal; i.e., over about 10. On days of an active magnetic field, look for north-south propagation only on the higher bands, with typical "ringing" or hollow-sounding signals from the auroral zone to the north.

Do not expect any DX on 40, 80, or 160 meters during the poorest days. Look for some VHF auroral openings, however, on the days when the magnetic field is most active. In particular, 6 and 2 meters should be good. While on the subject of VHF, the Geminid and Ursid meteor showers occur about the 13th and 22nd, respectively. Expect some meteor trail propagation on VHF bands during the peak showers. During the "Good" (G) days on the chart, you will find some excellent DX on 10, 12, and 15 meters—as well as on 20. Darkness comes early at this time of year and band openings will just about fade out at sundown, except on rare days when you may find early evening openings on 10 and 15. Your best times for DX will be toward the east in local morning hours and toward the west in local late afternoon hours. For those who enjoy DX on 40, 80, and 160 meters, the low atmospheric noise levels of December will provide a good opportunity to hear even weak DX signals, and days of quiet magnetic field conditions will help the countries totals of low-band DXers.

Late afternoon and early evening hours, as well as early morning hours, are the best times to listen for DX on the low bands. As always, keep your radio tuned to WWV at 18 minutes after each hour, for the latest propagation information. Consult the charts here for the most likely times to work the countries of your choice on Fair (F) to Good (G) days. Although the winter conditions are not quite as favorable for DX on the HF bands as they are in spring and fall, remember that solar flux is constantly rising along with sun spot activity, and the MUFs continue to climb during daylight hours. Although the northern hemisphere is tilted away from the sun in the winter, remember that the Earth, in general, is closest to the sun at this time of year! 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	-	-	-	-	20	20	-	-	-	15
ARGENTINA	20	40	40	40	-	-	20	15	15	10	10	15
AUSTRALIA	15	20	20	-	40	40	40	-	-	20	20	15
CANAL ZONE	20	20	20	20	20	20	20	15	10	10	15	15
ENGLAND	40	40	40*	40*	-	20	15	10	15	20	20	-
HAWAII	15	20	-	-	-	-	20	20	20	10	10	15
INDIA	-	-	-	-	-	-	20	20	-	-	-	-
JAPAN	15	20	-	-	-	-	20	20	-	-	-	15
MEXICO	20	20	20	20	20	20	20	15	10	10	15	15
PHILIPPINES	-	-	-	-	-	-	20	20	-	-	-	-
PUERTO RICO	20	20	20	20	20	20	20	15	10	10	15	15
SOUTH AFRICA	20	40*	-	-	-	-	20	10	10	10	15	20
U. S. S. R.	-	-	-	-	-	-	20	15	20	20	-	-
WEST COAST	15/20	20/40	80	160	160	160	-	-	-	10	10	15

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	-	-	-	-	-	-	20	-	-	-	15
ARGENTINA	20	20	20	40	40	-	20	20	15	10	15	15
AUSTRALIA	15	20	20	-	-	-	40	-	-	-	15	10
CANAL ZONE	15	20	40	40*	40*	-	20	15	10	10	10	15
ENGLAND	40	40	80	-	-	-	-	20	15	15	20	40
HAWAII	15	20	-	40	40	40*	40*	20	20	15	10	15
INDIA	-	-	-	-	-	-	-	20	-	-	-	-
JAPAN	15	-	-	-	-	-	-	20	-	-	-	15
MEXICO	15	20	40	40*	40*	-	20	15	10	10	10	15
PHILIPPINES	15	20	-	-	-	-	-	20	-	-	-	15
PUERTO RICO	15	20	40	40*	40*	-	20	15	10	10	10	15
SOUTH AFRICA	20	40	-	-	-	-	-	15	10	10	15	20
U. S. S. R.	-	-	-	-	-	-	-	20	15	20	-	-

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20	-	-	-	40	40	40	-	-	20
ARGENTINA	15	20	-	40	40	-	-	20	-	10	10	15
AUSTRALIA	10	15	20	20	-	-	40*	40*	20	20	15	15
CANAL ZONE	15	20	20	-	-	-	-	20	15	10	10	10
ENGLAND	20	40	40	-	-	-	-	-	15	15	20	20
HAWAII	10	15	20	40	40	40	-	20	20	15	15	10
INDIA	-	15	20	-	-	-	-	-	20	-	-	-
JAPAN	10	15	20	-	-	-	40	40	40	-	-	20
MEXICO	15	20	20	-	-	-	-	20	15	10	10	10
PHILIPPINES	10	15/20	15/20	-	-	40	40	40	-	20	-	20
PUERTO RICO	15	20	20	-	-	-	40	40	40	-	-	20
SOUTH AFRICA	20	20	-	-	-	-	-	-	15	10	15	15
U. S. S. R.	-	-	-	-	-	-	-	-	20	20	-	-
EAST COAST	15/20	20/40	80	160	160	160	-	-	-	10	10	15

*Try 80 meters.

The bands shown represent the highest usable at these times... on "Good Days."

Note that the lower frequency bands open first and close last.

DECEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
				1 F	2 F	3 F–P
4 P	5 P	6 P	7 P–F	8 F	9 F	10 F
11 F–G	12 G	13 G–F	14 F	15 F–G	16 G	17 G
18 G	19 G–F	20 F–G	21 G	22 G–F	23 F	24 F–P
25 F–P	26 P	27 P	28 P	29 P–F	30 F	31 F

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A	64,702	68,800
B 1	15,589	16,721
B 2	26,083	27,627
C	41,672	44,348
D	433	448
E	42,105	44,796
F 1	7,605	7,722
F 2	14,992	16,282
G	64,702	68,800

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